American Machinist

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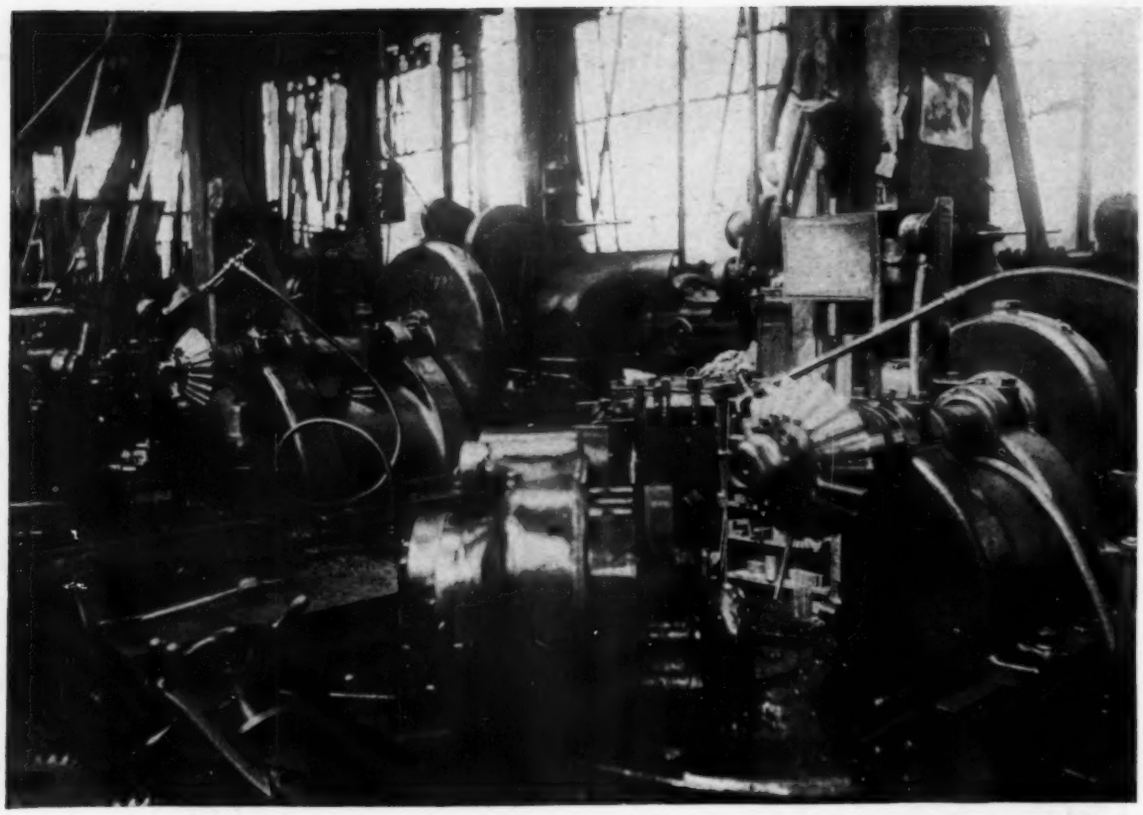
Pittsburgh Gear Brief for the American Machinist Awards for 1931

Although they have many a common denominator, no one who has not worked in both types of shop can visualize the differences embodied in mass production and intermittent manufacture. The management of one knows from week to week, and almost from year to year, what is going to be produced; the management of the other is lucky to know positively one day in advance. Tooling for mass production can never be called simple; but if one knows that he must produce so many thousands of a piece per year, he can plan with accuracy the tools he will need.

Possibly for one or another of these reasons, the Committee on Awards requested the publication of all eight finalist equipment replacement plans. Whatever the individual reasons of the members of the Committee, we are only too glad to present the plan of the Pittsburgh Gear & Machine Company on the following pages.

The company was organized in 1917. The management bought equipment from 1917 to 1920. Because deliveries at that time were poor on new machine tools, some old ones were taken on. Almost immediately, a regular nine per cent allowance for depreciation was set up, and when 1928 swung around, there was an adequate reserve for replacement—a cash reserve separate and distinct from corporate surplus. Used modern tools being greatly in demand in 1928, they brought high prices. The management was pleased to find that actual depreciation on one group of tools was eighteen per cent less than reserved depreciation. On the other hand re-used used tools showed losses without exception.

J. H. Jackson, sales manager, unfolds an equipment policy of wide application. It certainly fits his own plant. And we are of the opinion that it will fit countless plants with similar problems, plus maintenance and repair shops attached to non-metal-working plants.



24-in. and 37-in. Gleason bevel gear planers finishing teeth on 10-in. miter gears. These new units showed savings of 23-53 percent over the tools they replaced

Planned Replacement

In A 14-Year-Old Plant

J. H. JACKSON
Sales Manager, Pittsburgh Gear & Machine Company

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Established in 1917 with almost all new equipment, the Pittsburgh Gear & Machine Company began its replacement in 1928 with the adequate reserve for replacement set up in the interim. Replacement of even comparatively new equipment has speeded production, increased accuracy, and multiplied profits*

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*Brief entered for the *American Machinist* Award for 1931, Class II. Selected by the Committee on Awards for special consideration and publication.

THE Pittsburgh Gear & Machine Company manufactures cut gears of all types—spur, bevel, spiral, worm, etc., sprockets for roller and silent chains and a small volume of shafts, bushings, ratchets and similar miscellaneous parts which are occasionally purchased with gears. Our maximum capacity is 72 in. for spur gears and 48 in. for bevels, with the bulk of production under 24 in. in diameter. Our output is sold principally to machinery builders manufacturing standard or special machines for re-sale, together with a smaller volume sold directly to the consumer, either for replacement purposes or for new machines being built to be used in his own plant.

This is strictly a jobbing business, all parts being made in accordance with drawings and specifications furnished by the customer. Engineering assistance is frequently given to our customers, and thus some of the gears that we make incorporate our ideas of design. But on the larger part of our output it is not possible to exert this influence. As a result, we are continually machining parts designed by engineers primarily to perform a certain function in a machine. Since it may not be known in advance where the machining will be done, the machining facilities cannot be given consideration.

This condition makes it necessary to select machine tools that are adapted to the production of widely varying designs—a much more difficult problem than the purchase of machines to produce certain specific parts,

as is done in a production shop. Also, in the latter type of business, the designer can frequently proportion his parts to suit the available equipment without compromising any desirable features of design.

Many orders for gears of this type are for one or two pieces; for standard machinery the lots vary from five up to twenty-five or fifty, with occasional lots of five hundred to a thousand. It is therefore necessary to have equipment that is quickly set up for the small lots and, at the same time, can be adapted to economical production of longer runs. Single-purpose machines must be avoided entirely and preference given to machines adapted to all types and a wide range of sizes, even at the expense of slightly lower output. Machines are available that might be unusually fast on a certain type or size, but they would stand idle when none of that work was in our shop.

The company's original equipment was purchased during 1917 to 1920. Very few purchases were made in the next seven years, but in 1928 and 1929 a replacement program was started, which, although not yet completed, resulted in over fifty per cent of the production hours in 1930 coming from machines less than two years old. Some departments, such as the turret lathe department, have been one hundred per cent re-equipped. Results so far have been without exception very satisfactory from every angle—reduction of costs, improved quality of product, decreased maintenance and tool expense, and elimination of delays in production.

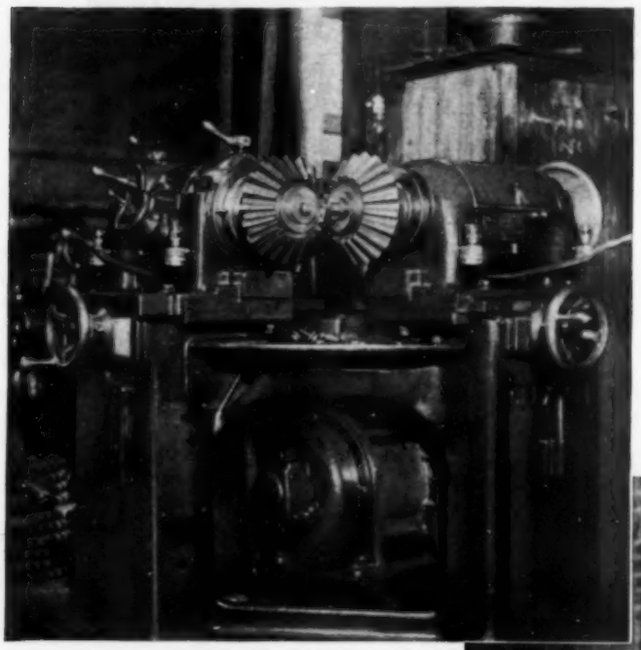
In considering the replacement policy of the company, one must remember that replacement problems in our plant differ radically from those in older plants. Almost all of our machines are less than fifteen years old, equipment which many would consider comparatively up-to-date. Our replacement program is simply an effort to keep a shop, which might be regarded as already up to the minute, equipped with the latest and best in machine tools. In other words, our program is not one of necessity, but rather follows out the basic idea of our business—that we shall always be equipped with the best tools. This then is the story of the benefits accruing to a company whose old equipment was well suited for its work and was not really out of date.

The following machines are being operated at the present time:

8 Engine lathes, 14 to 24-in. swing.
11 Hand turret lathes, $1\frac{1}{2}$ to $7\frac{3}{4}$-in. spindle capacity
2 Automatic turret lathes
10 Rotary cutter type spur gear cutters, 72-in. maximum diameter
6 Shaper-type spur gear cutters, 36-in. maximum diameter
6 Worm and worm gear hobbing machines, 24-in. maximum diameter
4 Bevel gear generators, 24 in. maximum diameter
3 Bevel gear planers, 48 in. maximum diameter
2 Plain milling machines
1 Horizontal milling machine
1 42-in. vertical boring mill
2 Internal grinders
2 External grinders
6 Drill presses
2 Keyseating machines

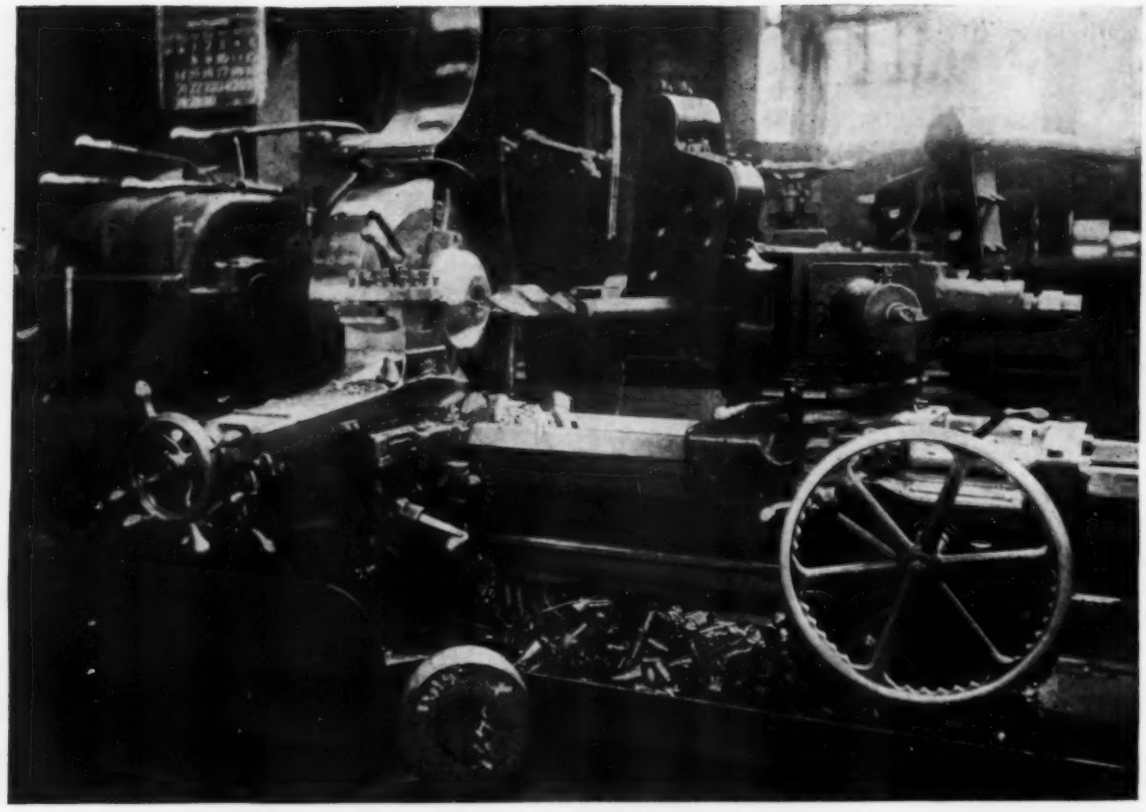
Miscellaneous equipment—shapers, saws, tool grinders, presses, heat-treating equipment, air compressors, etc.

These are standard machine tools with the exception of a few of the older machines that we have re-built or altered slightly to machine a part that could not otherwise be handled. We plan to continue these in service along with some other machines that are still in good physical condition and are not yet made obsolete by ini-



Testing bevel gears on a Gleason testing machine. Increasing standards of accuracy necessitated its purchase

Heald "Sizematic" grinder finishing the bore of a 10-in. miter gear to size after hardening. Production increases ranged from 39 to 66 per cent with this new equipment



Drilling a 3½-in. hole in a gear blank on a No. 4-A W & S turret lathe. This new machine made savings of 19-37 per cent

provements in current models. Incidentally, there are not many in the latter classification.

The machines bought in 1917 to 1920 were mostly new, although a few used tools were purchased due to inability to obtain delivery on new machines during the war period. This equipment averaged about ten years old when we began our replacement program. During this period an average annual depreciation of nine per cent of the original price had been written off in our costs and an adequate reserve for replacement thus set up. We were therefore in a position to dispose of machines that were not yet antiques and replace them with up-to-date tools without disturbing our corporate surplus.

Specific examples of our depreciation results with several typical groups of machines follow:

Group "A"

Ten No. 2A and No. 3A Warner & Swasey turret lathes

Year of purchase	1917 to 1920
Year sold	1928 to 1929
Average age when sold	10.4 years
Original cost	$26,620
Actual depreciation	$13,054
Total hours of operation	211,497
	(76.5 per cent of standard 54-hour week)
Actual depreciation per hour	6.15 cents

An estimated depreciation of $22,650 had been written off against these machines, which, as will be noted, proved to be excessive. The principal reason for this difference was because the machines were sold during the period of active demand for used tools, and a relatively high price was obtained for them. Had we realized from their sale only their book value, the depreciation would have been 10.7 cents per hour of operation.

Group "B"

Five 36-in. spur gear generators

Year of purchase	1917 to 1918
Year scrapped	1929 to 1930
Average age when scrapped	12.2 years
Original cost	$5,150
Actual depreciation	$5,150 (no salvage)
Total hours of operation	80,120
	(48.5 per cent of standard 54-hour week)
Depreciation per hour	6.45 cents

These machines had been completely depreciated on our books and were scrapped when replaced. Their second-hand value was very small, and it was thought better to scrap them than to sell them at a low figure and thus help set up new competition in an already crowded field.

Group "C"

Two internal grinders

Year of purchase	1917 to 1919
Year scrapped	1927
Average age when scrapped	9.4 years
Original cost	$2,046
Actual depreciation	$2,046 (no salvage)
Total hours of operation	34,695
	(68 per cent of standard 54-hour week)
Actual depreciation per hour	5.9 cents

These were purchased as used machines and when scrapped were being carried on our books at a valuation of $425. Scrapping was necessary because of physical wear and tear and not because of obsolescence. The depreciation rate on this group was inadequate.

Group "D"

Six Brown & Sharpe and Newark rotary spur gear cutters

Year of purchase	1916
Machines still being operated in 1931	
Average present age	15 years
Original cost	$10,065
Depreciation written off	$10,065
Total hours of operation	171,973
	(71 per cent of standard 54-hour week)
Depreciation per hour to date	5.8 cents

These machines are due for early replacement, but have been retained in service for various specific reasons. It is probable that a total of over 200,000 hours will be obtained from them, bringing the cost per hour down to about five cents. Current design of this type of gear cutter is not radically different, and thus these machines have not been affected by the obsolescence factor.

Considering the entire group of machines that have been replaced, our actual realized depreciation has been about eighteen per cent less than the amount charged each year into our costs. It was desirable to have this margin of safety to provide against the rising trend in machine tool prices that existed up to 1929. Whether this trend will be reversed in the next few years cannot be foreseen, but at this time it is at least stationary. This condition presents a new angle to the question of basing depreciation (and other costs) on replacement value rather than original cost.

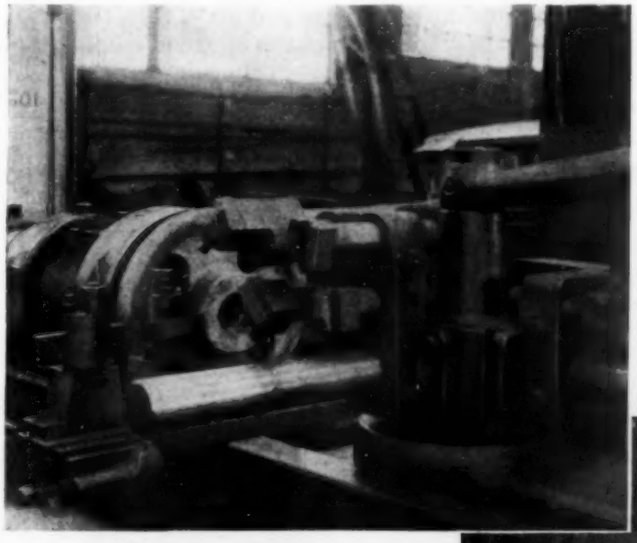
We discovered that we had made a mistake in handling the few used tools which we were operating. Applying the standard rate to their cost to us was not sufficient, and without exception we incurred a loss on them. For example, a bevel gear generator purchased second-hand completely wore out in eight years and had to be scrapped with a loss of $625 to be charged off. It showed a depreciation of twenty-eight cents per hour, whereas a new machine of the same type and age is still operating, although it is one hundred per cent depreciated on our books. It would show a depreciation of only twenty cents per hour if scrapped today without salvage. Our conclusion is that used machines should be depreciated with the standard rate applied against their new cost or with a special rate against their used purchase price.

With an adequate depreciation program, as outlined above, we do not consider it necessary to use any formula to determine when the purchase of a new machine is necessary or justified. Such formulas may be of considerable assistance in a production shop where the purchase of a new tool is made for the manufacture of a specific part. For the jobbing shop the decision as to when to buy and what to buy is much more difficult because the purchase must be made without knowing exactly what the new tool will be required to turn out next year, or even next month.

Our opinion is that a proper depreciation rate will permit of buying an improved tool and selling the old one without a capital loss at any time after the latter is five years old at most. Of course, the longer a machine can be profitably run, the more certain it becomes that the depreciation will cover wear and tear as well as inevitable obsolescence. There is relatively little danger of premature scrapping due to the latter factor on general-purpose machines because their development is usually gradual. On the other hand, a special-purpose machine might easily become obsolete in a few months.

The most important result from the use of the new equipment was the greatly increased production. The actual amount of increase varied greatly, but from a comparison of relative time on a large number of items that are being made regularly, we have obtained the following approximate increased output:

	Per Cent
Turret lathes	25
Rotary type spur gear cutters	30
Bevel gear generators	40
Spur gear shapers	45
Internal grinders	45
Miscellaneous	20 to 50



A Potter & Johnson automatic, setup to machine a 15-in. C. I. spur gear Tungsten carbide (Carboloy) tools are used throughout on this item, and on a standard machine

Among products of the Pittsburgh Gear & Machine Company are miter gears. Here in one group are a rough drop forging, a turned blank, and a finished 10-in. miter gear

Specific examples are given below. These are not isolated, hand-picked items, but are thoroughly representative of hundreds of similar parts.

Turret Lathes

Item	Old Time, Minutes	New Time, Minutes	Saving, Per Cent
"A" 10 Steel Worms, 5½ in. diam. x 5 in. long	48	39	19
"B" 20 Steel Worms, 4¼ in. diam. x 5¾ in. long	45	32	30
"C" 100 Steel Spurs, 5⅝ in. diam. x 3 in. long	33	24	27
"D" 100 Steel Sprockets, 3 5/16 in. diam. x 1½ in. long	19	12	37
"E" 50 C. I. Worm Wheels, 4.33 in. diam. x 1⅞ in. long	21	15	29

Rotary Type Spur Gear Cutters

On this type of machine the increased output can be very accurately determined, since it varies directly with the rate of feed of the cutter slide. These rates have been stepped up 20 to 40 per cent as standard practice.

Bevel Gear Generators

Item	Old Time, Minutes	New Time, Minutes	Saving, Per Cent
100 Alloy Steel, 18 T., 3 DP, 2 -in. Face	34	20	41
25 Alloy Steel, 16 T., 4 DP, 1¾-in. Face	24	15	37
10 Carbon Steel, 15 T., 3 DP, 2 -in. Face	48	37	23
25 Alloy Steel, 24 T., 6 DP, ¾-in. Face	42	21	50
10 Alloy Steel, 16 T., 4 DP, 1¼-in. Face	39	24	39
100 Bronze, 20 T., 10 DP, ¾-in. Face	15	7	53

Spur Gear Shapers

Item	Old Time, Minutes	New Time, Minutes	Saving, Per Cent
25 Alloy Steel, 52 T., 4 DP, 2 -in. Face	35	18	50
25 Carbon Steel, 24 T., 4 DP, 1½-in. Face	30	17	45
20 Carbon Steel, 26 T., 6 DP, 1¼-in. Face	25	17	32
20 Carbon Steel, 34 T., 6 DP, 1¼-in. Face	27	19	30
5 Cast Iron, 136 T., 8 DP, 1¼-in. Face	140	90	36

Internal Grinders

Item	Old Time, Minutes	New Time, Minutes	Saving, Per Cent
25 9 -in. Gears, Hole 1 13/16-in. diam. x 2½-in. long	18	11	39
25 4 -in. Gears, Hole 1½ -in. diam. x 3¼-in. long, tapered	23	12	48
25 3½-in. Gears, Hole 1¾ -in. diam. x 2-in. long.	13	6	54
200 5½-in. Gears, Hole 1 13/16-in. diam. x 4-in. long.	18	6	66

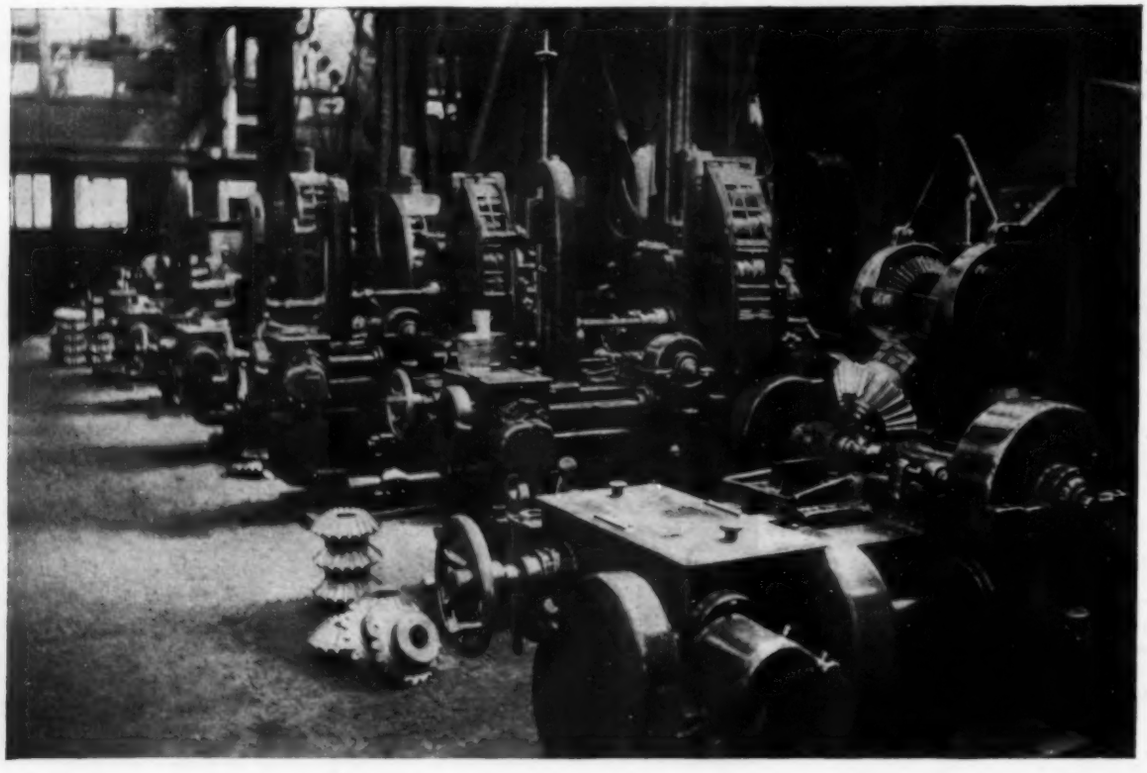
All of these figures include setting-up time. Since this is about the same on both old and new machines, the actual operation time shows an even larger percentage of saving. One the larger runs, therefore, the economy of the new machines is more evident, since the time for setting-up and changing blanks becomes a smaller percentage of the total elapsed time.

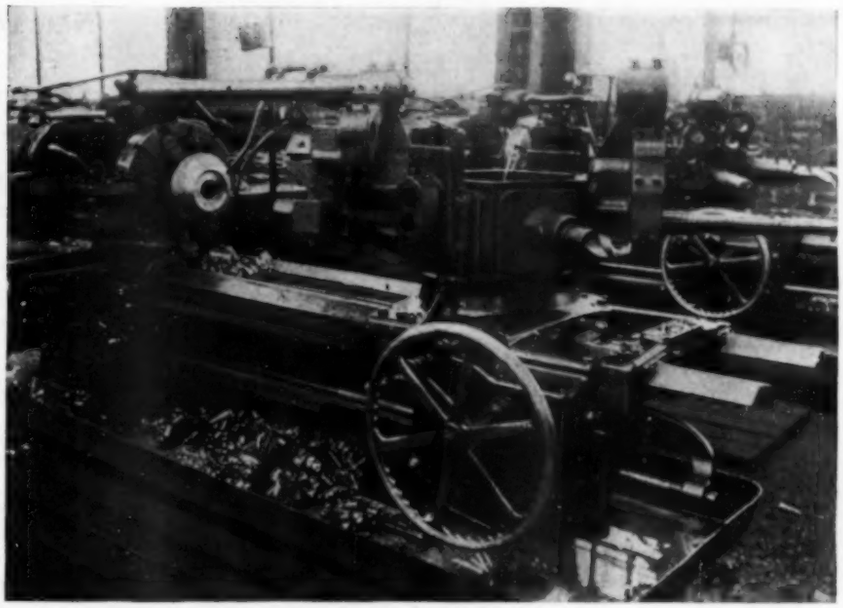
When considering the above figures it should be pointed out that we followed the plan of replacing first the machines that were most out of date and that some of our future replacements may not show up quite so favorably from the production angle.

An equally important result, although more difficult to evaluate, was the improved quality of work obtained from the new machines. This would reasonably be expected with any new tool compared to an old one, but has been very pronounced due to the fact that recent designs have stressed rigidity—the work and the cutting tools being held firmly in position so that heavy cuts could be taken without resulting in chattering, deflection of spindles, work arbors, cutter arbors, etc. More convenient adjustments have made it easier for the operator to work to closer limits.

Inspection of purchased parts by machinery builders is becoming more severe, and a degree of accuracy that was acceptable during rush period of 1928 to 1929 does not suffice now. To have met this situation with our old

Newark gear cutters set up for roughing out the teeth of 10-in. miter gears. These new units increased production 20-40 per cent, depending upon the piece being cut





A No. 4-A Warner & Swasey turret lathe set up for a 10-in. miter gear. The finishing tool head is swung slightly out of position to show the set-up that finishes the face angle, front angle, and front depth. Piloting is dual—by the bore and by an overhead bar guided by the machine frame

equipment would have required an expensive overhauling and tuning up and no definite assurance of satisfactory results.

Improved quality has been particularly valuable to us on gears for precision machinery. A certain pair of 10 D.P. bevel gears used on a high-speed printing press were continually causing us trouble. They operate a reciprocating frame which picks up the paper and feeds it to the machine, using a finger arrangement that lifts the paper with a very light vacuum. If there is not a smooth, uniform motion, the vacuum is lost and the paper dropped. Consequently, the gears must be cut and set up with absolutely no backlash. Variations in the teeth, no matter how slight, cause trouble. Our costs were running high in an attempt to secure unusual accuracy not inherent in a 10-year-old machine, and the customer was far from being satisfied. The gears are now being cut on a new generator, and the quality is entirely satisfactory. The customer is doubly pleased due to a lower cost. We could lower the price because our time on this operation was reduced from 31 to 14 minutes. Similar beneficial results have been obtained on gears for bottling, canning and other types of machinery where certain motions are required to register accurately and where small errors in the gears throw the mechanism out of proper timing and stop the process.

Another valuable machine from this angle is an internal grinder which automatically sizes the bores of gears uniformly after the first one of each lot is ground. With limits in bore frequently as low as 0.0005 in., an accurate machine is necessary for this operation. At this stage the work is about completed and spoilage means a loss equal to the full price of the gear. An equal amount of defective work here may cause five to ten times the loss that would be incurred by spoilage on the early machining operations. This machine also is of great value to us, because its high production eliminates delays at the end of the processing—where delays in production schedules are the most expensive.

An appreciable saving in cost of repairs and tools has been experienced. One striking example was an old keyseater. Although periodically repaired, it was impossible to maintain in good condition. Not only was the character of the work unsatisfactory, but the worn condition of the machine caused excessive breakage of cutters. During the last year it was operated, cutters worth $115 were broken, although the machine had been depreciated to a value of only $65 on our books. It was replaced by a new machine of the same make; in the following year our total cutter cost was reduced to $58. This machine handles only small lots and production savings are small because of the high percentage of setting-up time, but it has proven a good investment from the standpoint of improved product and reduction of loss from spoilage, excessive repairs and cutter expense.

The use of new machines capable of producing more accurate products soon developed the necessity of using more accurate cutters, true arbors and bushings for mounting the work and better gages, micrometers and inspection fixtures. Unless these features are watched, the greater accuracy possible with modern machine tools cannot be realized. The new bevel gear generator previously referred to produced gears having errors too small to measure with our old testing machine, and it was necessary to purchase an improved testing machine. Also, for the same machine a special tool grinder was bought to obtain correct tools. It is not used for any other purpose.

The new generators and gear shapers have so greatly reduced the time for actual production operations that it has been necessary to give more consideration to setting-up, loading and unloading the work, changing cutters, making adjustments and other dead time. For example, on the old machines, if the operation required thirty minutes and the dead time was three minutes, this was only ten per cent, but with the operation cut to fifteen minutes, it becomes twenty per cent. If possible, this time must be restored to ten per cent. In the jobbing trade this is a hard problem, because it is not possible to make duplicate sets of cutters, arbors, and special fixtures, as is done in a production shop to overcome such conditions.

On such machines it has frequently been found economical to reduce the number of machines per operator from three to two, or even from two to one, in order to insure continuous production. On small items, with a production time of five to ten minutes, there will be excessive idle time if an operator is running too many

machines. For this reason, we have no hard and fast rule, deciding each situation as it arises.

An unexpected result from our purchase of new lathes is that our present machines have higher speeds and greater rigidity, and can be used with the new tungsten-carbide tools to the limit of their capacity.

An interesting incidental result of our replacement program is worth mentioning. When the new machines were installed, individual motor drives were substituted for the former group drives. As a result of having a large number of small motors, each running at a lower average percentage of normal rating and with more frequent starting and stopping, our power factor dropped to about sixty per cent. This is a very undesirable type of load for public utilities and they encourage its correction by offering an alternate contract to purchase kva. hours at a lower rate instead of kw. hours. If kva. hours are bought, a 100 per cent power factor is a prime necessity. A General Electric "Capacitor" was installed to make this correction. It cost less than five cents per day to operate and effected a 25 per cent saving in our power bill, saving its entire cost in twenty-three months.

Many concerns have been reluctant to purchase new tools to replace those bought ten or fifteen years ago because of the sharp increase in machine tool prices, feeling that it is more economical to continue operating old tools that are completely written off, even though they may not be as productive as current models. It is true that a higher return per hour must be realized from the new tools, but we find that we can obtain it and at the same time reduce our cost per unit of product. A comparison between our old and new Warner & Swasey turret lathes is interesting:—

Average investment per machine—new group (11 machines) $4,985.00

Average investment per machine—old group (10 machines) $2,662.00

Increased investment per machine..... $2,323.00

Assuming 6 per cent interest and 10 per cent depreciation per year, the additional fixed charge is 0.16 × $2,323.00 = $372. Assuming 2,000 hours per year, this is 18.6 cents per hour. All other costs—labor, supervision, building expense, cutters, administrative—are practically unchanged, resulting in an increased cost of not over 10 per cent (based upon a total cost of $2 per hour on the old-style machines). Since production increases of 20 to 25 per cent can be obtained, the purchase of the new machines is justified from this standpoint alone, not considering improved quality or other benefits previously discussed.

Our experience to date has convinced us that we have made no mistake in re-tooling our plant, and in spite of the unsatisfactory outlook in 1930, we spent for new tools in that year the full amount of our depreciation write-off, which was ten per cent.

Any manufacturer who plans to replace his old equipment will discover that merely buying the machines will not bring results. These new tools bring up new problems that must be solved by the management, and intelligent supervision is more important than ever before if the full possibilities of the machines are to be developed.

Frequently, suggestions can be offered that will effect the slight economies necessary to turn red ink into black—especially with the close profit margins existing at the present time. It must be remembered that if machinery users' profits are not adequate, the replacement program for which tool builders are hoping will be long deferred.

New Developments in Grinding Tungsten Carbide

Certain new developments in grinding tungsten-carbide tools are reported by "Carboloy," house organ of the Carboloy Co. The trend at this company's shops has been from hard wheels to soft wheels, and it is their policy to sacrifice wheel wear for quality. They are naturally, however, trying to arrive at the happy medium from the standpoint of wheel cost, while realizing that too much wheel wear may be objectionable.

As a result of numerous tests, their present standard is approximately 0.020 to 0.035 grams of tungsten carbide removed per 0.001 in. of wheel wear, with the strength of the tungsten carbide being between 200,000 and 250,000 lb. These figures were determined with a 7x½x1¼-in. wheel on a surface grinder having a spindle sped of 3,200 with standard table traverse and cross-feed. The down-feed is kept constant at 0.002 in. for every time the cross-feed is reversed. This method for testing suitability of grinding wheels has resulted in a material reduction in the percentage chargeable to cracking in the company's spoiled work.

Wheels from 60 to 120 grit, or even finer, are specified, depending on the job or finish required. Bonding and grading of the wheels is most important, and that company prefers the softer rather than the harder wheels. It is necessary to watch closely for signs of wheel glazing and excessive heating. The closer the grinding operation can keep to producing a lapped edge the better the performance of the tool will be. Practically all tools produced by that company are diamond-lapped.

For the average grinding wheel, speeds of around 5,000 to 6,500 ft. per min. have been found satisfactory. It is suggested:

(1) That lighter feeds be used for the harder grades.
(2) That softer wheels be used for the harder grades.
(3) That wheels be dressed frequently to keep them from glazing and heating the work.
(4) That care be used while clamping in vises and that no unnecessary tapping be done on the tungsten carbide or even on the shank.
(5) That if a coolant is used, be sure it is a heavy flow.
(6) That no tungsten carbide should be dipped in water for cooling purposes during grinding.
(7) That grinding should not be done continuously in one spot.
(8) That the wheel spindle on any type of grinder be kept snug and free from vibration.

Wet grinding is a safeguard and should be used wherever possible. Grinding of tungsten carbide is hard on the grinding equipment, and the greatest care must be exercised to keep the machines clean, if the grinder is to operate accurately and efficiently. Any additional time spent and care used in the proper grinding of tungsten-carbide tools will amply repay the user.

■

In wringing gage blocks together, the amount of adhesion at either end is often not the same. This causes an out-of-parallel condition, and the combined measurement at opposite ends may differ by several hundred-thousandths. A recently perfected device reveals this condition, so that the blocks can be wrung together again to obtain parallelism.

Finding the "Average Man"

JOHN YOUNGER
Professor of Industrial Engineering, Ohio State University

THE average man is a peculiar individual in our shops. He surrounds us, yet if we want to put our finger on him, we find he is exceedingly hard to catch. We want to know who he is in our machine shops so that we may base our piece-work rates on his performance. Seemingly the task is easy, but when we investigate we find all sorts of complications.

Three or four factors enter. One is the factor of skill, or the ability of the man to do the work intelligently. Another is the factor of effort, or the desire of the man to do the job at slow or top speed. A third comprises conditions surrounding the man, whether he has proper ventilation, illumination and so on. A fourth might be the incentive you give the man to arouse him from his human lethargy.

With four factors facing us we realize that a workman may possess these factors in varying degrees. For

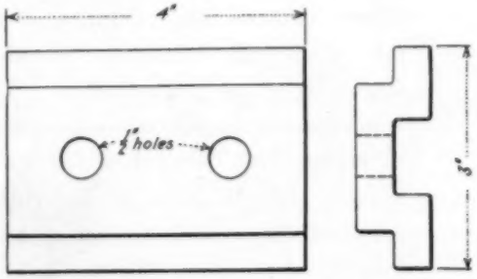


Fig. 1—Example of work used to ascertain the relative speed of students

example, a man may have great intelligence or skill but be inherently lazy, and there may be insufficient incentive to waken him from this slowness. If he has maximum skill but minimum effort he may be mathematically regarded as the average man, but humanly speaking you can hardly look upon him as such. He is an exception.

So the first conclusion we arrive at in our search for the average man is that we must discard the exceptions. We arrive therefore at a definition of the average man as one possessing average skill, average effort with normal conditions and normal incentives.

If we base our piece-work rates or bonus rates on this man, when we strike the "above average" man we will have to pay him more money, but the increase of pay should be commensurate with the increase of work. Conversely if we strike the "below average" man, then his rate of pay will be lower because we get less work from him. Under average actual conditions if we have a job that will run for some time with different men as operators we should set our rate for the average man. This is the only fair procedure.

We should not cut the rate of the occasional better man because later on, when we are bound by the law of averages to get a poorer man, we would have to readjust our rate again.

If in our time study we could take the times of ten normal men, then we would probably be right in assuming that the average time of the ten would be the time of the average man. But we don't always find that we have ten men or even the time to go through their procedure, so we have to find the time of our average man by some estimating process.

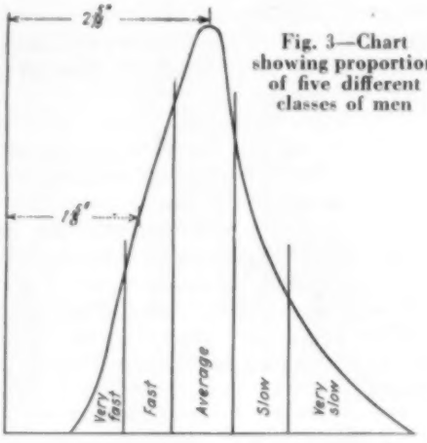


Fig. 3—Chart showing proportion of five different classes of men

I have for some time been struck with the variable curve and the uses to which it can be put, so I began to consider it and its possibilities in the application of the variables of time study. The curve can be put to a great number of uses. It has a bell-shaped outline as shown in Fig. 2, a shape that persists in an astonishing number of fields.

I found that it applied as a chart showing the times normal men took to do a specific job and the number of men doing that job. I took 250 students who had reached a specific standard in workshop practice and experience in our university. I gave them a piece of cast iron as in Fig. 1. Each man was told to mark off by means of dividers, scriber and scale the center punch marks for the two holes. He was then required to drill the two holes. The over-all times for the operations were taken by stop watch and recorded. The result was a chart as shown in Fig. 3.

The very fast men are near the origin of the ordinates; the very slow men are far away. We can therefore divide up our curve or chart into zones, as shown in Fig. 3, with very fast men, fast men, average men, slow men and very slow men plotted into these zones. Comparing the center of these zones with the ordinate representing the center of the average zone we find that the skilled zone is 70 per cent of the way towards the center. In other words the average man is 70 per cent slower than the skilled or fast man.

Thus we have the beginning of a scientific ratio between various rates of speed and the average man. Unfortunately we still have to rely on judgment as to how slow or fast a man really is, and this judgment must come from experience.

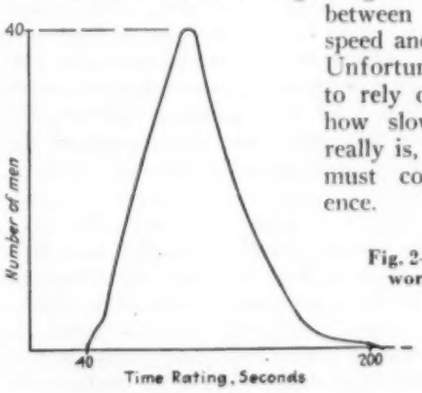


Fig. 2—Time rating on the work shown in Fig. 1

EXECUTIVE

Dominant or Dumb?

Promptness and positiveness in decisions are used by many executives to demonstrate their powers of leadership. When coupled with a thorough knowledge of the business, this policy often commands respect. But others contend that dominance by one man kills initiative in other members of an organization. The subordinates become so accustomed to saying "yes," they lose the spontaneity that is born of individual responsibility. Which course have you found the more effective in your business experiences? Who gets the maximum results—the forceful business leader or the man who sits back and listens? What do you think?

THE conference had just adjourned. It had been called to review certain features of a new line of machinery the Masfield Foundry and Machine Company proposed to manufacture. Because of his familiarity with the market for such products, Bill Holland had been invited to sit in at the meeting. As they filed out of the conference room, Bill found himself next to J. J. Masfield, founder and chief owner of the business.

"What was the matter with you today?" asked Bill. "This is the first of your conferences I've attended in a good many years, but it's not like the old days. I can picture you now sitting at the head of the table, pounding it occasionally, and laying down the law. You dominated the whole show. But today, you simply sat back and quietly listened to ideas that you'd discarded years go. Why, you're forgotten more about these machines than some of these young chaps ever learned."

Masfield smiled good-naturedly. "Yes, I used to be all three rings in the circus and rather gloried in it. I came out with positive decisions, and no one questioned them. But one day, I woke up to the fact that those tactics caused my assistants to lean on me rather than to do their own thinking. I don't have all the brains in the organization, and my old attitude just stifled independent initiative."

"I see your point," said Bill, "but if you'll pardon my saying so, today you acted positively dumb. If I hadn't known you well for all these years, I'd have classed you as one of those executive figureheads, making an ineffectual attempt to look intelligent."

"I've found that's the best way to bring out new suggestions from my associates," said Masfield. "The louder I talked, the more they were inclined to accept my dictates without question. They took little part in our discussions, and I suspect, did little thinking. They learned to look to me as an oracle that solved all their problems. So I completely reversed my tactics."

"But I know a lot of executives who follow the opposite course," said Bill, "and apparently with success. They pride themselves on giving prompt judgments and prefer to be wrong occasionally than indecisive at any time. And I must say, they seem to inspire their subordinates with the idea that they are real leaders."

"Some businesses can be run that way," said Masfield. "But nine times out of ten, men of that type do themselves and their followers an injustice. Creative ideas and company policies become more and more dependent on the say-so of one individual. When the time comes that the individual has to step out of the picture, the company may flounder through lack of leadership."

"Getting back to this morning's session," said Bill, "don't you waste a great deal of time rehashing old ideas which some of these youngsters advance as new?"

"My old method, of stepping on them promptly, was likely to discourage the man who made the suggestion. These ideas, even when not original, show that a man is thinking constructively. It's good exercise, and eventually he'll think of something new that will help the business. Retracing the old ground is worthwhile if it leads to fresh endeavor."

"But I don't think your subordinates give you credit for your knowledge and experience when you take so passive a part in these meetings."

"That I can't say," said Masfield. "But I'm beyond the point where I put dependence on the personal pride of expounding my own views. To develop men and independent thinking is the best course for all of us."

FORUM

Discussions Of Former Subjects

Stockholder vs. Employee

When dividends are not earned, they can either be paid out of surplus or passed altogether. When the president of a manufacturing concern is confronted with the problem of cutting the wages of his employees in order to pay dividends, there are many angles that should be considered before making a decision.

In the case we are discussing, the employees already received a 10 per cent wage cut, which reduced their purchasing power by this amount and possibly further. It is true, that in times of depression, the cost of living is lowered but never in the same ratio as the cut in salaries or wages. The reduction of wholesale prices is not always reflected in retail prices, as these vary considerably in different communities.

Where dividends are not earned, it would seem logical to penalize the stockholder as well as the employee. In the case in question both parties have had to take a reduction. The employees feel it more keenly than the stockholders because the average employee, even in normal times, does not accumulate any large surplus. The high cost of living in boom times does not permit this.

The management should take into consideration that the cutting of wages has a serious effect on the employees' morale, and this resentment will remain when conditions improve. It has been the writer's experience, during the past year, that a great many valuable employees have deeply resented wage cuts that were unfair, particularly in concerns that are known to have substantial surpluses. These employees will not remain with their present firms any longer than it will take them to secure another job. It will probably cost more to replace them than the apparent saving made by reducing their salaries or wages.

The stockholders and directors in a great many instances are wholly responsible for the fact, that their company was unable to earn dividends, because of the tight hold they kept on the purse strings when the management requested appropriations for the replacement of worn out or obsolete equipment, or money to be used for the improvement of the product. It is the writer's opinion that it would be far better to pass the dividend than to cut the salaries and wages of the employees, as this affects the welfare of the entire country.

—C. B. Cole, *President, Tool Equipment Sales Company.*

The Up Grade

I'd chose the technical man for that job of assistant superintendent. The practical man might be better liked at first by the shop men, but the technician would be more respected. The difference is that the technical man would, in all probability, get more real effort from the force. Theoretically, shop men should work harder for one of their own number who has been promoted. Actually, a great deal of ill-founded jealousy always exists, and this feeling holds the men from putting out their best efforts. The practical man, too, is prone to temper his judgments of personal problems with his knowledge of personal conditions of the men affected, instead of deciding those matters on the strict merits of the cases. The technical man comes from a slightly different world, and is more likely to be impartial in his decisions.

When to these facts is added that as time goes on the technical men will no doubt develop into the more mature executive, it seems logical to select him as the man for the job. The ideal thing to do would be to chose the technical man, at the same time, give some salary recognition to the practical man.

—James K. Matter, *Aluminum Cooking Utensil Company.*

The selecting of employees for promotion is not only one of the most interesting but also one of the hardest tasks confronting the busy executive. To make the task harder, there are no fixed rules that can be laid down.

It is apparent that Reynolds has had no experience in handling men or any actual responsibility of producing. With that in mind, I would promote Boyle to the assistant superintendent's position, as his experience has fitted him for it and put Raynolds in Boyle's place. As foreman, Reynolds would gain invaluable experience, and it would be found out if he could handle men and had executive ability.

While timestudy and ratesetting are necessary in the modern factory, the men engaged in them rarely have had much experience in actual producing and often make poor foremen.

If Reynolds' technical experience is such as to make him a potential exeutive of the company, he could just as well be promoted from foreman, after having gained the experience, as well as he could from the position of assistant superintendent. Too much stress has been put on technical training in the last few years, as being the only essential needed to make a sucessful executive, whereas nothing can take the place of actual experience, gained in the factory, particularly that gained as a foreman.

—P. W. Abbott.

One Line or Many?

One good line has much to recommend it. Machinery and processes, however elaborate and detailed, are generally relatively simplified and constant. The machine operators are usually by sheer repetition specialists on that particular work. Mass production methods are wholly or in part applicable; and consequently, costs of manufacture are comparatively low. There can be urged the fact that many of yesterday's best and quickest selling lines are today pitiful back numbers. That has to be taken seriously into account. More than merely possessing a present good selling proposition is necessary. The intelligence department must reconnoitre carefully the country ahead. Present demand must be reinforced by reasonable prospects for the future.

Where there is great competition, not only as between rival manufacturers and suppliers, but especially with regard to alternative service, it is obvious that there may arise the direct need for taking on new lines. In that case, it is good that the new shall not be too great a departure

from the old. Too often the drastic departure requires that new machines, equipment and new processes of manufacture shall be launched. So long as the new venture does not mark too clean cut a break with precedent, there is hope that it will prove profitable. Time, grit, and skillful application are necessary.

—W. R. NEEDHAM, *Design Engineer, English Electric Company, Stafford, England.*

Does Frankness Pay?

An employee of any grade from laborer to works manager, who wants to move, is wise to keep his own counsel until he is sure of his new job. He will have to give such notice of his intention to leave the service of the company as is determined by his contract or by the custom of the trade. It is the business of the company to protect its interests by arranging for this notice period to be of sufficient length and for every executive to be understudied by a man who can take the place of his superior at short notice. There is no more disloyalty in getting a job with another corporation than there is in getting killed in an automobile accident. The executive can go to his president with his new contract, in his pocket feeling able to discuss the matter as a free man. Without it, he can only beg for consideration. It is no more unethical for an employee to look for a new job while holding the old one than it is for the corporation to seek a new executive without giving notice of its intention to the one it already employs.

—H. J. BURNHAM, *Birmingham, England.*

Marking Time

A firm which adopts a conservative policy and waits for its competitors to start the ball rolling on new lines of manufacture will be in a stable condition financially, though it will not find itself in the forefront of industrial endeavor and is not likely to pay high dividends. At the present moment in England, industrial concerns seem to be divided into two distinct groups, one conservative, the other rushing forward with elaborate programs, which is far worse than being conservative. I am connected with a large radio and gramophone company, which this year is placing on the market no fewer than ten distinctly new models while most of its competitors are satisfied with three. It must be emphasized that these models are not merely redesigned but are the product of considerable research and are new departures. It is a bid for big business, but because a large number of models involved, the first schedules are kept low yet they are expected to cover all the tool costs. Obviously, tool costs themselves must be kept low.

If all firms acted in a similar manner, the whole country would be plunged into a haphazard state, and the markets would be glutted with a huge variety of machines at a price to high for the average customer. Generally speaking, cost reduction on existing models comes cheaper than the production of an entirely new design. At the present state of the trade as a whole, it seems preferable to reduce the selling price rather than put something new on the market.

—C. B. GORDON-SALE, *London, England.*

Shirt Sleeves or White Collars?

A few years ago, the efficiency expert, was hailed as the savior of industry, and although now somewhat debunked, he has increased his satellites by the addition of production managers, planning engineers, cost experts, and the all embracing term of industrial engineers. These individuals, representing the authority of management, rub the workers the wrong way, by appearing to harry them on details, report back to cause trouble, and are hated accordingly. Systems are necessary but are often overdone. Small business, today, is making the larger corporations take notice, and this on account of their greater flexibility, or lack of killing systems and overhead, as they are able to secure orders at lower prices and make money. Of course, the conduct of a small business and a large corporation cannot be done in the same way, but why shouldn't common sense be used in both cases? The point of the workers against the overhead, as the office is usually termed, is not all sincere, but neither is the planner or production man, with the wrong angle on the main idea of making money, and not building a glorified system. To see the truth in both cases, and balance them for the common objective, is the task of the manager.

—JOHN S. ISDALE, *Plant Engineer, International Silver Company.*

Shifting the Burden

Economic depressions, whether they be merely local or on the scale of the general debacle of the past twenty months, arise from two basic roots. One of these roots, we can call unemployment of human capacity, while the second is the unemployment of mechanical capacity. Of these two, the first is of the most importance, for while idle machines represent capital, the unemployment of man-power hits directly back at the spending ability of the individual not to mention the physical, moral, and mental suffering, which poverty occasions.

A large group of people, responsible for the direct support of themselves or others through the earnings of their efforts, who because of unemployment have no income of any sort, represent from an economic standpoint that many buyers taken from the market. The need for supplying that market is thereby reduced, and in turn, the manufacture of material to meet the need is eliminated, so that the vicious circle is completed. On the other hand, the output of a single machine might supply an entire year's needs for its products in a few hours of operation and still justify the expense of its creation, so that idleness at this point need not be serious.

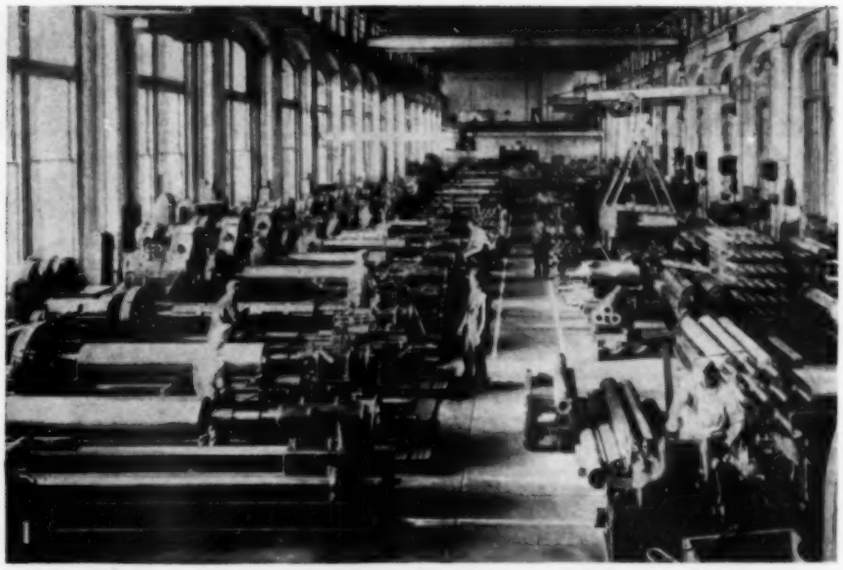
If this long-drawn-out depression has proved anything from the standpoint of our general economic condition, I believe that it is that before we can hope to find ourselves depression-proof, we must organize to so distribute our labor requirements so every individual, responsible for the support of himself or others, shall have his proportionate share of whatever opportunities for gainful employment there may be at the time.

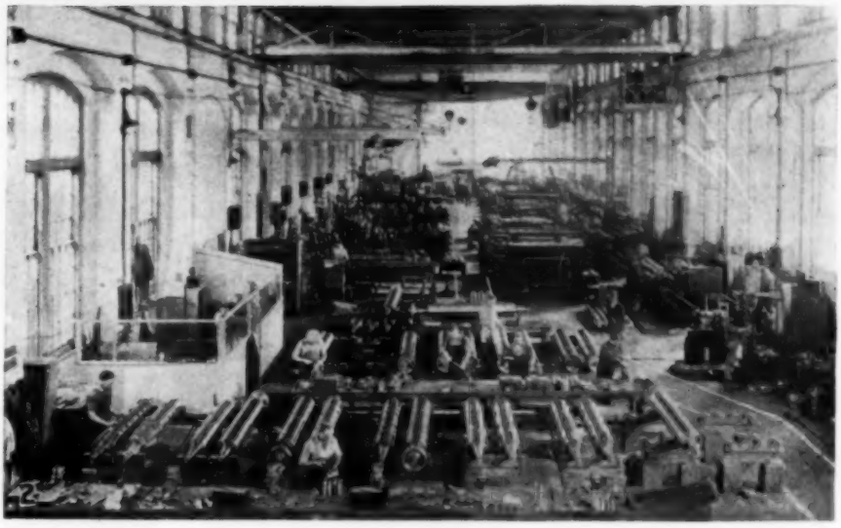
The carrying out of such a program involves real problems, but unless we accept the economically unsound proposition of a fluctuating pauper or charity class, supported by some sort of dole at the expense of the rest of the population, it would seem inevitable that our ultimate plan must be based on some such fundamental as an equitable distribution of labor.

With every one assured of the opportunity of earning something, general spending, while curtailed at times, would never be completely stopped at any point, credit would be stabilized, and our general situation made pretty nearly fool-proof.

—D. C. WRIGHT, *Works Manager, Graver Tank & Manufacturing Co.*

Advances in Printing Press Manufacture





Job shop practice has been supplanted by production methods in the building of printing presses. This first article of a series describes modern trends in machining

PRINTING press building, particularly in the case of large presses for newspaper and magazine work, grew up with the idea that each press differed so materially from every other as to prevent anything approaching standardization. As a result, presses were designed for the special job, with little regard to what had been made previously, and built along job shop lines. Huge side frames were erected after a minimum of machining and squared by stretched wires, plumb lines and levels. Brackets were put on with C-clamps, and after tedious lining up, were drilled in position with hand ratchet or air drills. Parts were milled in one department, drilled in another and turned in a third, having traveled many hundred feet with delays and expense at each move. Such was the procedure in the old plant of R. Hoe & Company, which was typical of the industry built up by the demand for rapid printing. And after a press was laboriously built, assembled, and tested, it was disassembled, shipped piecemeal to the customer, and again assembled in his plant. The reassembly frequently took many weeks and required careful aligning and checking.

Several years ago the management of R. Hoe & Company took the bull by the horns, freed themselves of the handicaps of old and unsuitable buildings, modernized designs on the unit plan, replaced old equipment with new machines, introduced new methods, and sidetracked traditions that had long prevented keeping pace with modern trends in manufacture. Work was planned and routed so as to avoid backtracking and all other unnecessary travel, to flow steadily through the machining departments from there to the subassemblies and the final erection floor. Cooperation between the engineering and production departments results in designs that can be easily manufactured on the available equipment although new machines are purchased whenever necessary to maintain the new policy.

Jigs and fixtures have replaced the old plan of laying out holes, drilling to prick-punch marks, and locating brackets by clamps for drilling matching holes in the frames. Production has not been handicapped by trying to utilize old machines when new ones save time and do better work. During the past three years, two-thirds of the old machines have been replaced by modern ones. Fixtures have been made in duplicate wherever machine time can be saved by so doing. As an example of the changes, five modern turrets replaced 24 lathes in the production line, and while a few of the old machines

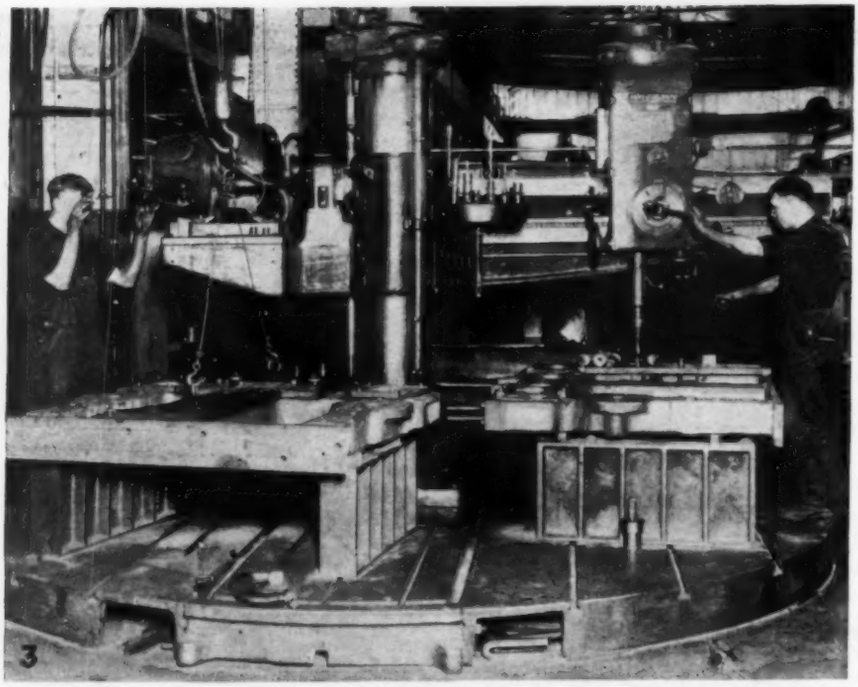
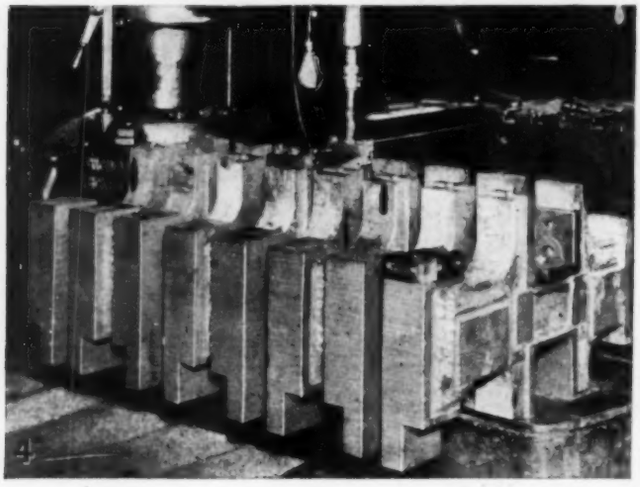


Fig. 3—Idle time on expensive equipment is avoided by duplicate set-ups. While the operator machines one frame, the helper gets the next ready

Fig. 4—This set-up on a radial drill saved seven hours out of eight and insured interchangeability

Fig. 5—When to plane and when to mill has long been an open question. The merits of each method are recognized in finishing the steel side frames



are still used on special, nonproduction jobs, even these are scheduled for replacement. Other work is being shifted to turret lathes, especially where comparatively small center drilling is one of the operations. Records of operations have replaced memory, which is always more or less fickle, insuring that succeeding lots will be done by standard methods so that costs can be known in advance. Nearly all jobs are on bonus, and prompt, regular attendance is rewarded by vacations with pay.

A general idea of the way in which new equipment predominates and of the routing to secure a steady flow of work through the different departments can be had from the accompanying illustrations. Cranes of several types facilitate the handling of heavy parts. Aisles are kept clear, which not only adds to appearance but also makes for safety. Many standardized parts are made for stores, from which they are drawn as required by the assembly department. The storage racks have been built of standard shapes and are adaptable to arrangement for different uses. They permit easy inspection and can be moved readily as plant expansion or rearrangement demands.

Those who recall the old methods of building printing presses will appreciate the changes typified in the cylinder shop, Figs. 1 and 2. Instead of being carried from one end of the shop to the other, as well as taking trips to other floors, the cylinders now pass as nearly as possible in a straight line from the first operation to the last. Overhead traveling cranes of 10- and 20-ton capacity serve the whole cylinder shop, while 2-ton jib cranes, swinging from the side walls make it easy to handle work locally. After the machining is done, the cylinders pass to the other end of the shop where gears, clamps for holding curved electrotypes, or stereotypes, and other attachments, are put in place.

An expensive machine only earns money while it is

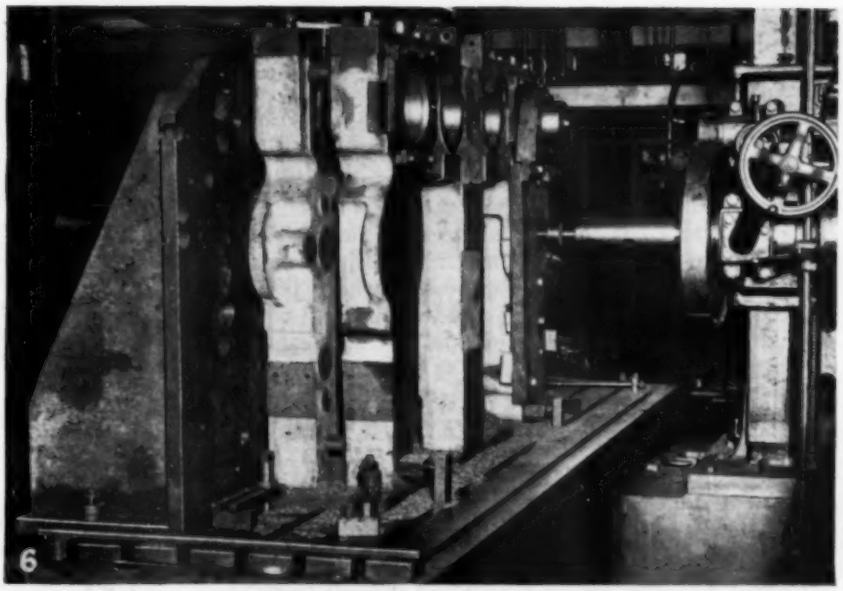
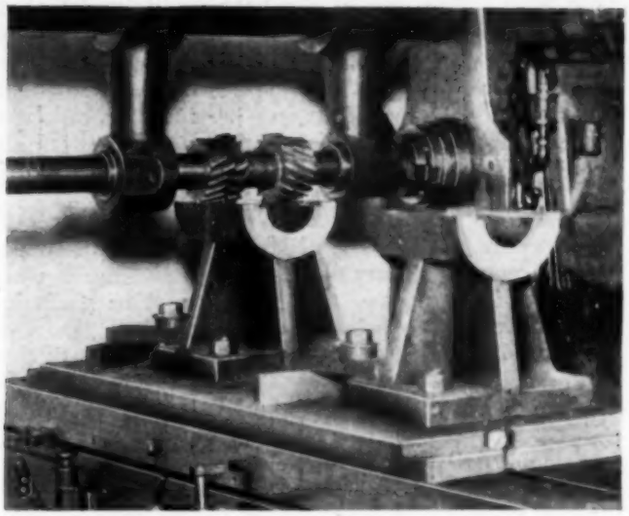


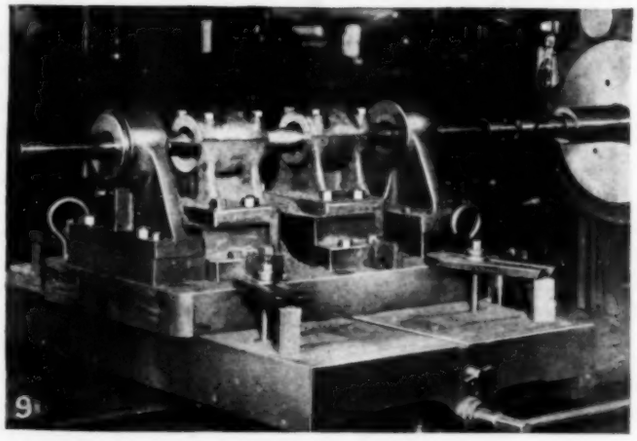
Fig. 6—Frames are jig bored in pairs to insure accurate alignment

Fig. 7—A double set-up saves time in the milling of cylinder bearing boxes

Fig. 8—Another milling job uses four cutters to finish the bearing cap seats

Fig. 9—A simple fixture is used to bore and face the assembled bearing brackets





working, and set-up time frequently steals much of its potential earnings. The radial drilling machine in Fig. 3 is therefore provided with a large semicircular base with double supports for the work and two sets of drilling jigs for such of the work as warrants this investment. In the case shown, over 34 per cent was saved by this method. While the operator is at work on one side frame, the helper places another on supporting blocks and puts the drill jig in place. In this way, the radial can be kept at work practically all the time, by simply swinging the arm from one job to the other. The saving given takes into account the cost of the helper and the extra equipment. This saving of machine time on expensive tools is not fully appreciated in many shops. It frequently pays to employ several helpers if necessary to reduce the idle time of the machine.

Machine time is also conserved in the set-up in Fig. 4, the flexibility of the radial drilling machine enabling a number of castings to be drilled at the same set-up. These are also side frames but of a different type. Small jigs that are easily handled are located from planed surfaces in each case and holes drilled at three different locations on each casting. The old method was to first drill the caps, then to use these as jigs for spotting the

drilled holes in the frames. Some of the holes, such as for the impression screws, were laid out and ratchet drilled on the erecting floor. The present method carries a premium time of one hour each, which is just one-eighth of the time required by the old method. And in addition to the saving in time, the pieces are now uniform.

An appreciation of the advantages of both milling machine and planer, each in its place, is indicated in Fig. 5. The practice is to mill surfaces of the kind shown on the side of the castings and also such intermittent surfaces as pads and bearing bosses, where the work can be moved rapidly from point to point and the pads milled quickly. For machining the bearing seats, however, the planer comes into play as shown. To machine these surfaces by milling would require a number of expensive cutters, and the number of frames built does not warrant such an expenditure.

After the various surfaces have been planed and the side of the bearing seats roughed out, these surfaces are finished by the special tools shown on each head. The shank of these toolholders is a flat plate, planed to fit the top of the clapper block, and held in position by four bolts. The end of the holder is forged back to bring the cutting edges of the tools behind the pivot pin of the clapper block and so acts as a spring tool. The cutting tools themselves are simply straight bars of high-speed steel held to the tongue by the four capscrews shown. These tools not only finish the surface but also size the housing to receive the bearing blocks.

Interchangeability from Jigs

An example of the use of large jigs to secure duplication in center distances of holes is seen in Fig. 6, where bearings for cylinders and for ink motion shafts are being bored in a horizontal machine. After the large cylinder bearing holes are bored at the top of both frames, the jig shown is positioned in one of these holes, and the smaller holes beneath bored in their proper place. Substantial jig bushings guide the boring bars through the plate, one being shown on the bar. This insures commercial duplication and aids greatly in erecting the machines on the assembly floor. This type of jig is inexpensive to make, as standard bushings can be used in many cases, special bushings being of course necessary for some holes.

A typical set-up for a plain milling job is seen in Fig. 7, where the sides of printing cylinder boxes are being milled in a double fixture. The work is easily located by the positioning strips on the base and clamped by the large flange on top. The block at *A* is a cutter gage or "tell-tale" used in setting the work to the cutters. Similar cutter setting gages are used on nearly all milling fixtures, it being standard practice to use a 0.030-in. feeler between the cutter and the gage.

Another double fixture milling set-up is seen in Fig. 8, this time on a No. 4 Cincinnati, in which the grooves are being milled to fit the corresponding tongues on the bearing caps. The ends of the bearings are also milled on the same fixture using a set-up that swings the bearings 90 degrees. After being milled and the caps fitted, bearings of this type are bored in a simple, but substantial, type of fixture as in Fig. 9. A large boring bar is guided in heavy bearings at both ends and driven through a double universal joint to eliminate all side thrust on bearings. The adapter shown is used for other operations, such as milling, holes being jig drilled so as to interchange.

Guessing Speeds From Other Fellows' Charts—*Discussion*

HARRY SHAW
Tool and Gear Consultant, Heywood, England

Charles R. Whitehouse (*AM*—Vol. 75, page 418) claims that timestudy is a far better method of setting rates than working from feed and speed charts. The writer claims that timestudy methods are open to nearly as great an error as feed and speed times. If the timestudy be made with the operator as the subject of the study, the times will vary with the operator, and if time studies are made with a special demonstrator, the time will vary with the demonstrator. Demonstrators, being human beings are likely to vary greatly.

At a recent meeting of the Manchester Section of the Institution of Production Engineers, the various timestudy experts were unanimous that the margin of error possible with time study methods was great. One example was cited—timestudy with a good turner, about 45 years of age, turning some square threaded screws, resulted in a time of four hours being set. Later, a youth obtained a time of 20 minutes each. The great difference was because the youth was able to withdraw the tool at the end of the cut, with the lathe running at a good speed, return the carriage, feed the tool in, and then catch the thread for the next cut. The older turner, and as a matter of fact practically everyone who tried his hand at the job, found it necessary to stop the lathe before the end of the thread was reached, and then "inch" along by hand to the end. Otherwise, they broke tools. This is the type of thing that can be encountered every day when skill or dexterity is necessary. Another point, which is variable, is "growing skill" on a particular job. One speaker, who was timestudy and ratesetter at a large chain works, remarked that while on some jobs an operator would in, say, six months obtain double the speed, because of growth of skill, others would never, no matter how long they were on the job, get double the output. Also, while the original time required for some jobs could be reduced to as little as a third, when the operator became more skilled, the original time for other jobs could not be reduced by as much as twenty per cent.

What the whole problem amounts to is that the time depends upon the operator and the job. Some jobs can be done practically as quickly at first as after months of experience, whereas others can be done in far less time with practice. Even good, experienced demonstrators or timestudy men will at times set false times.

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Harry Shaw also writes "John R. Godfrey said (*AM*—Vol. 75, page 428) that polished surfaces are not as likely to crack as are rough surfaces. Another thing about polished surfaces is that they will keep their accuracy much longer than rough surfaces and wear less.

"The writer has often been puzzled as to why firms will go to great trouble to specify the tolerance for fits, but do not trouble about finish. One designer specifies better finish on parts than would most designers, but on the other hand allows bigger clearances. He says, if a shaft rough ground will do with a clearance of one thousandth, probably a finely polished one would do with a thousandth-and-a-half clearance, for it will not wear slack as quickly as will the rough ground part.

"Finish is often more important than fit."

Automatic Spring Testing

HERBERT CHASE
Consulting Engineer

▼

A monotonous and time-consuming job is simplified by a machine that tests and sorts springs into any desired number of gradations

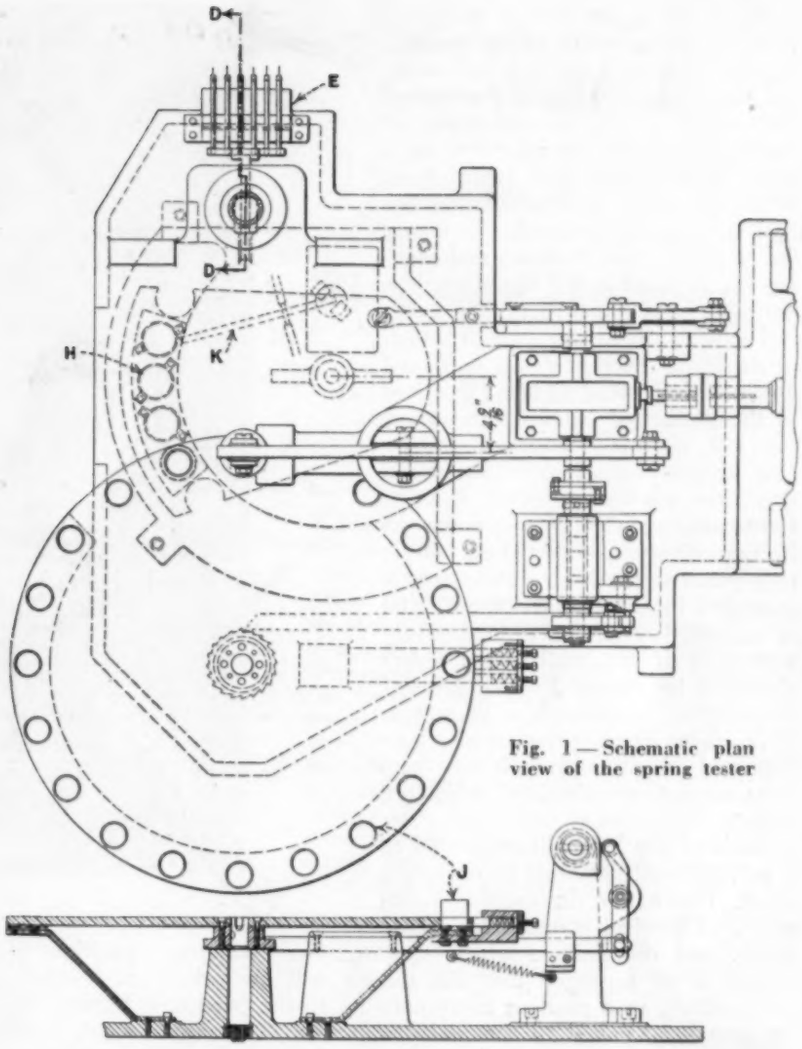


Fig. 1 — Schematic plan view of the spring tester

MANUFACTURERS who have occasion to inspect helical springs, with a view to grading them as to relative stiffness, know that it is a tedious and time-consuming job. Many machines have been designed for performing this operation, but the only automatic one the writer has come across is that designed by E. Marlin, gage engineer of the Chrysler Corporation. Its function is to sort the compression springs for poppet valves to make sure that the springs used in a given engine are "balanced" or deflect the same amount when subjected to a given pressure. The machine deflects each spring a certain amount and then sorts the springs according to the pressure it is necessary to exert for this deflection. Sorting within one-pound limits is readily achieved.

Once the machine is correctly set up and adjusted, it operates automatically. All the operator is required to do is to feed the springs into the recesses in a slowly rotating dial which indexes one space for each spring tested. Springs that leave the machine are discharged into one of six barrels or boxes. Into the first of these are discharged all springs which do not register up to the low limit permitted, say 75 lb. The second barrel receives springs in the 75- to 76-lb. range, the third those showing 76 to 77 lb., the fourth 77 to 78 lb., the fifth 78 to 79 lb. and the sixth all above the 79-lb. maximum limit. Thus, the first and last barrels contain rejects and the other barrels those within the four groups of allowable limits.

A schematic plan view of the machine is shown in Fig. 1. In Fig. 2 is shown an elevation and *D-D* section. Major parts of the machine include the loading dial, which turns above a platform scale; an oscillating shuttle, which is a part of the sorting mechanism and moves in a horizontal plane below the dial; a pressure-applying ram; and a 1-hp. 900-r.p.m. motor. Between the motor and the linkage which operates various parts is a speed reducer unit that provides a right-angle drive with the required reduction for turning the three cams which operate, respectively, the dial, the shuttle and the ram.

A column attached to the base of the machine carries an arm, which serves as a guide for the ram, and supports the pivot for the cam-actuated arm that operates the ram. This column just clears the edge of the dial, which turns about a vertical pivot also attached to the base. The dial is indexed one-twentieth of a revolution by a pawl and ratchet, and by a cam and linkage arrangement, at each revolution of the camshaft. Near the periphery of the dial are twenty holes, in each of which is inserted a short length of tubing to hold the spring while it is fed around under the ram. Under the openings

in the dial is a flat surface that prevents the springs from falling through the dial until they are indexed under the ram. At this point the spring rests upon an anvil the other end of which rests upon the platform of a scale of the ordinary beam type. When the spring is so positioned, the ram is forced downward, depressing the spring a given distance and causing the pressure to be transferred to the scale platform through the anvil.

The scale lever, one end of which is shown in Section *D-D*, is forced downward. Instead of being attached to the graduated beam of the scale, the rod normally attached to the scale linkage is attached to a calibrated Chatillon quick-stop spring balance. Consequently, the lever shown in Section *D-D* is deflected in direct proportion to the load. This lever is extended in the manner shown and is arranged to contact successively with each of six small copper levers shown at the top of Fig. 1. One of these levers is shown also in section *D-D*. The levers are pivoted on an insulated block, and each of them rests against an insulated adjusting screw.

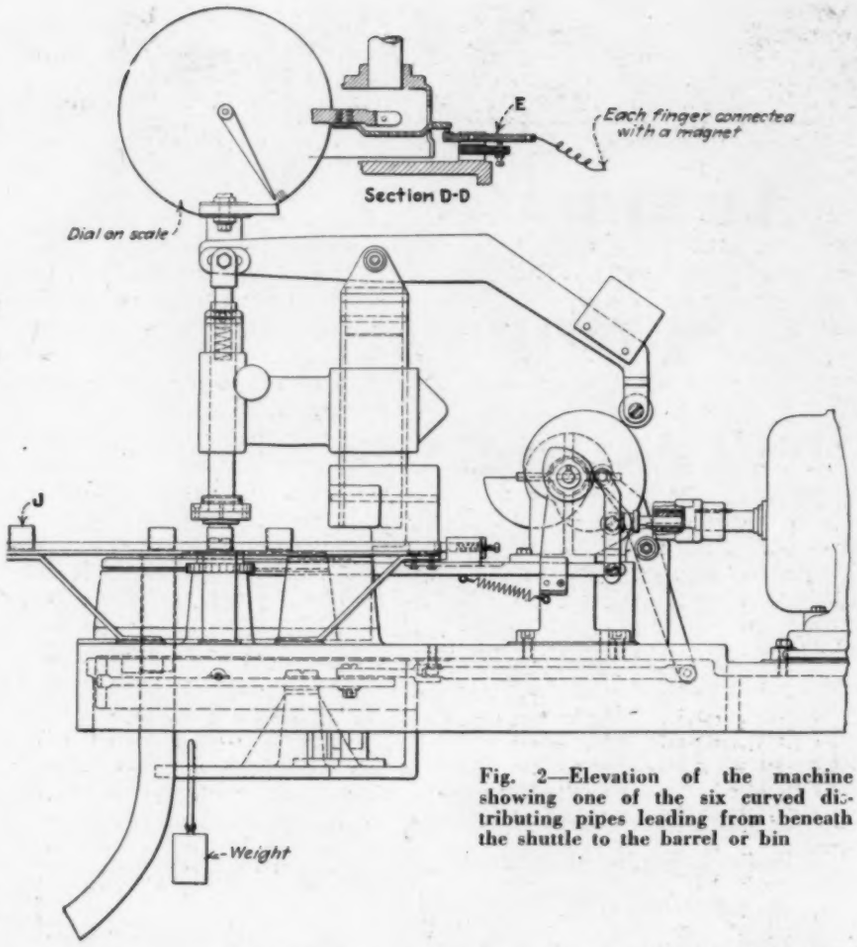


Fig. 2—Elevation of the machine showing one of the six curved distributing pipes leading from beneath the shuttle to the barrel or bin

Each of the levers is connected to a solenoid coil arranged to operate a lever. One of the six levers is shown at *K*. Electrical connections are so made, and the linkage which operates the oscillating shuttle is so arranged that the shuttle will be locked momentarily in a position corresponding to the particular pressure applied to the platform scale. The position at which the shuttle is locked depends upon the position of the platform scale lever. The latter, as already stated, is deflected in proportion to the pressure exerted by the spring being tested. The shuttle has a hole for each of the six barrels into which the springs are to be delivered. When the spring is shifted by the indexing of the dial into a position over a given hole, the spring drops through and is conveyed into the proper barrel. Motion of the shuttle, which swings in an arc, is effected by the cam and linkage shown in Fig. 1. The positions of one of the solenoids and the stop lever which it controls are shown by the dotted lines in the same section.

In common with most automatic machines, this one appears somewhat complex when viewed as a whole. Each of its major assemblies, however, is simple, and all are synchronized by placing the operating cams on the same shaft. Return motions of the parts are effected by springs or weights, which, though not positive, are adequate for the purpose.

A machine of this type is capable of sorting about 1,300 springs per hour, whereas an operator with testing equipment such as is usually employed for similar work would not test over 600 springs an hour.

Sodium Silicate Solutions Provide Graded Cooling

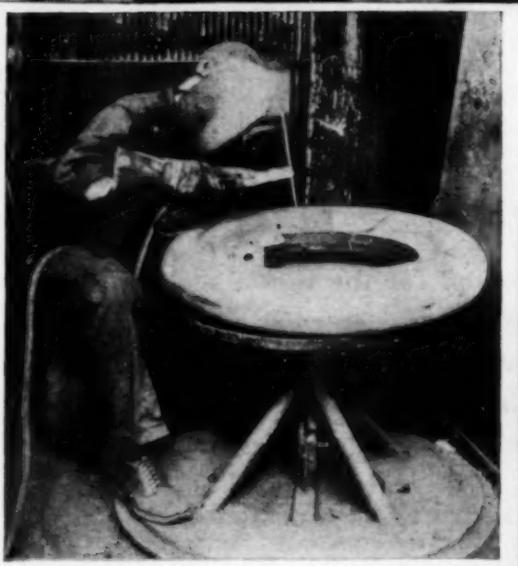
WATER and oil, the two most common quenching media, have widely varying cooling effects, resulting in the necessity for a tempering treatment. A steel equivalent to, or possibly better than, the quenched and tempered steel would often be possible if quenching solutions were available possessing characteristic cooling rates between those of water and oil.

In a recent investigation at the Bureau of Standards a study was made of aqueous solutions of ethylene glycol, glycerine, and sodium silicate to determine whether any of them offered promise as quenching media with characteristic cooling rates in this intermediate range. It was found that the solutions of glycol and of glycerine did not give results which were readily reproducible. Hence, such solutions do not appear promising for practical use. However, solutions of several concentrations of sodium silicate proved to have quenching rates in the desired intermediate range and to give very consistent results. Some of these sodium silicate solutions must be treated with small additions of caustic soda in order to prevent changes in them when allowed to stand for several months. The effect of varying the concentration and the temperature of the sodium silicate solution was studied. It was concluded that sodium silicate solutions give promise of usefulness in the quenching of steels by providing solutions having graded cooling rates between those of water and of oil. The September Bureau of Standards Journal of Research give the full report.

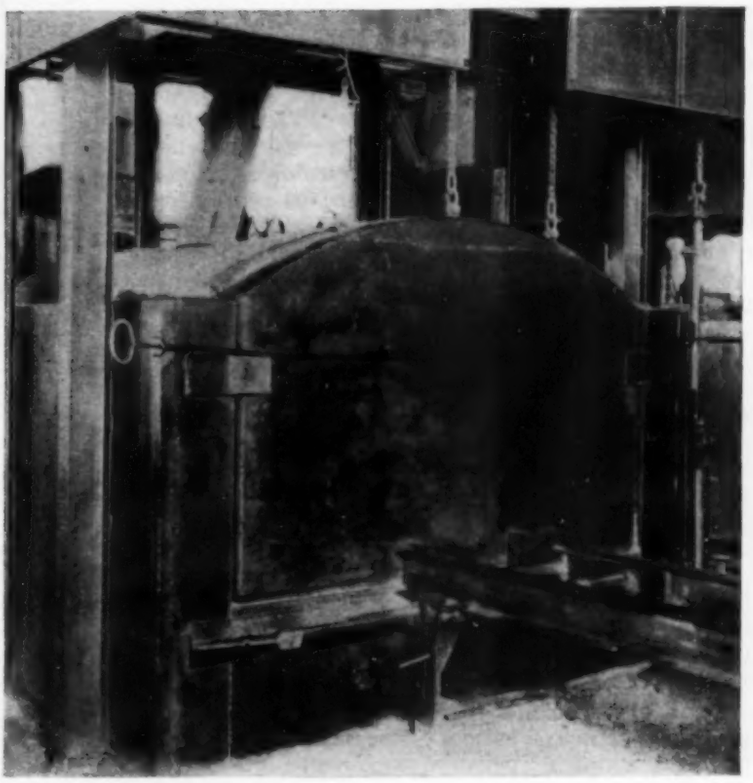
Arc-Welding in a Tire and Rubber Plant

Practically unknown thirty years ago, welding can now be found in any industry using metals, either for fabrication or maintenance. Among seldom-suspected users of welding are rubber manufacturers. Here are pictured three typical arc-welding jobs at the Akron, Ohio, plant of the Goodyear Tire & Rubber Co. Dowel pins in rubber heel molds were formerly screwed in. Now they are welded in as at left, and the same process is used to build up worn surfaces and edges. A reclamation job on a tire core is pictured at lower left. The 1/16x1/16-in. groove was formerly repaired by cutting out and inserting a 5/8x5/8-in. filler ring; now the groove is simply welded up and recut

Photographs courtesy C. M. Taylor, vice-president, Lincoln Electric Co.



With the welding equipment handy, a wide variety of odd jobs will inevitably find easy solution. Retaining rings for large hose connections, pipe welds, welded tools, benches, and racks are common examples, but at right is a new one on us—an all-arc-welded carburizing furnace. It is welded up of boiler plate, angle iron, railroad rails, I-beams, and probably a few other choice bits of scrap, but has been in constant use for three years without repairs except those normally incidental to brickwork



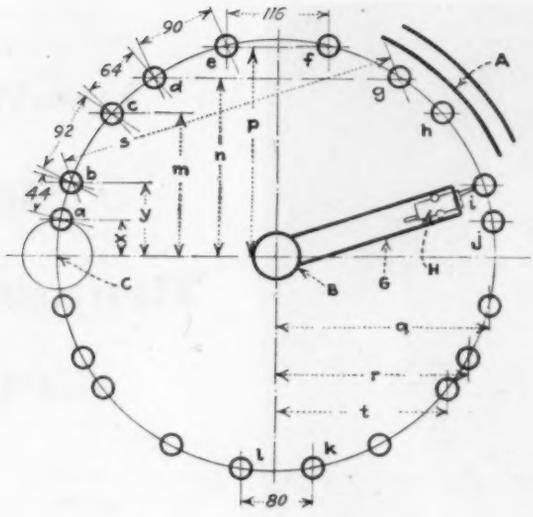


Fig. 1

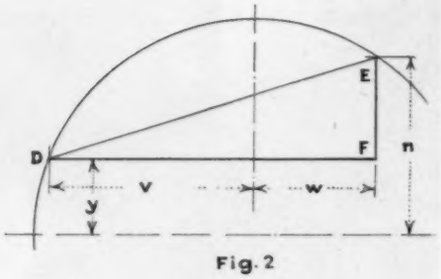


Fig. 2

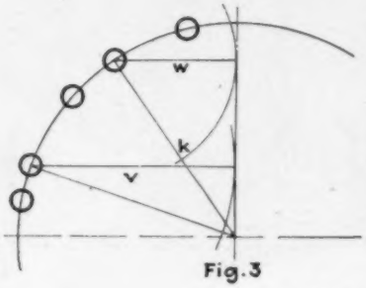


Fig. 3

Laying Out a Drill Jig

WALTER WELLS

A CIRCLE of twenty holes were to be bored in the body of a jig for the seating of as many drill bushings. The button method of layout, or set-up, was to be used. But the job presented some unique problems which had to be overcome by correspondingly unique methods.

The first thing, out of the ordinary, was the unusual number of buttons to be set up, making for an accumulated error, and the consequent "crowding" of the last few buttons to be set, were they to be set consecutively. Then we encountered an uneven spacing of the chords, eliminating the possible use of some sort of spacing device. Further, there is a general awkwardness about the job itself—its large size (O.D.—about 20 inches) and the presence of an outside rim, which not only prevents the use of a gage to locate inward from the periphery, because of its rough-finish, but effectually interferes with the use of micrometers in every direction. Nor is it a typical job for the use of the height-gage and indicator exclusively, because the four quadrants of the circle are not symmetrical. It would take too much time to get the readings for the successive resettings from horizontal to the perpendicular.

This jig is designed to drill the screw holes around the face of a large cylinder. The uneven spacing of the chords is explained by the fact that various units, with two holes each, and left- and right-hand settings, are to be screwed to the cylinder together with the cap.

To a certain extent, in this article, we will have to deal with the metric system of measurement. Wherever practical, a rough English approximation will be given, but in dealing with the check-up and tolerance limits, we have to consider that a set of Johansson metric test blocks were used, and the Russian tolerance limits, which are also metric, followed throughout. The latter, by the way, are as follows: 0.02 mm. (0.0008 in.), preferably 0.01 mm. (0.0004 in.) for the button set-up; 0.04 mm. (0.0016 in.) for the bored-out hole; and 0.05 mm. (0.002 in.) for the pressed-in drill bushing. The Jo-blocks progress by 0.01 mm. from 1 to 1.5 mm., and then on up by halves and integers, the largest block being 100 in. long (4 in.). Thus any combination, as in the English set, can be wrung together.

Referring to Fig. 1, chordal dimensions are given metric for convenience. For instance, chord *ab* reads 44 mm. The body design and clamping devices on the jig are purposely omitted to concentrate attention only on the points under discussion. With this in view, only two physical details are shown, namely, a suggestion of the outside rim, at *A*, which as we stated, interferes with the micrometer readings, and the central plug which is the registering point for the radial measurements.

Except for the use of metric measurements, toolroom problems are much the same in Europe as in the United States. Here is an interesting one the author ran up against in Soviet Russia

Beginning at the left intersection of the center line and working around clockwise, we see that the chord spacings vary. When we get to the next quadrant, we note that the spacings repeat themselves in reverse order (see the parallel projection lines). In the third quadrant, we have an entirely different order of spacing, which can be readily seen by comparing the first three buttons here with any three in the preceding quadrants. The fourth quadrant is inversely related to the third. Lastly, observe

that chord *ef* is unlike chord *kl* on the opposite end of the vertical center line, thus defeating any attempt to indicate these pairs up horizontally within reasonable time limits.

To solve the problems offered in this job with the least amount of resistance, a combination of checking methods was used all at one time as an alternative to the customary method of shifting the job from horizontal to the perpendicular. Each button was given a final setting before tackling the next one; no return trip was contemplated, nor as we shall see by the method to be described, was necessary.

First, the center plug was nicely ground to fit. Then a flat strip of cold-rolled steel, $\frac{1}{8}$x$1\frac{1}{4}$ in., was shaped to fit around the center plug (see *B* and *G*) and cut off somewhat short of the circle line. A bent scriber was attached to this so that the circle line could be scratched on the coppered surface of the jig body, using a height gage to determine the radius line and setting the scriber to it. The chords were laid out with dividers, as nearly as reasonable care could make them. Then all the button locations were scribed to $\frac{1}{2}$-in. diameters as sharply as possible. After the holes were drilled and tapped, the burrs were removed with a drill so as not to obliterate the circles, as is many times done with a file. The buttons were then screwed down nearly "home", using the circles as a guide. These precautions save much time on long jobs, such as this.

The Setting

With the buttons all on, we began the setting. The strip *G* was fitted with the Koch indicator in place of the scriber, the clamping stud having been removed from underneath. A vernier height gage was used to set the first button *e* according to the dimension *p* (given on the blueprint) attaching thereto a different type indicator. This setting, for all practical purposes, yields us our radial distance from the center, so we adjust the Koch indicator so that it reads zero against this button. Or, to be more exact, just 0.01 mm. more was added to the radius than the dimension on the print called for. This was done to prevent the crowding in the chord spacings, which always happens if no such "nursing" within the tolerance limit is allowed. This crowding is probably resultant from a slight leaning of the buttons, causing the gage readings to be taken only over the high spots. The indicator gage is made to traverse the buttons clockwise only, to assure uniform readings.

We now revert to button *a*. It is first set radially with the special gage. Then the gage is clamped lightly in position, maintaining its zero reading (the design of the jig permitting this), while the vertical setting is accomplished with the height gage and indicator. Using a piece of $\frac{1}{8}$-in. brass wire, flattened and rounded out on the end, and a light hammer for tapping, we rarely disturb a cross location of a button. (There is a theory to this.) Button *b* is set the same way, with the added precaution of counter checking with the Johansson blocks for the intervening chord. Button *c* is skipped for the time being for a reason which will be presently explained. At this point, it must be mentioned that all that applies to the left side of the jig, pertains also to the right, so we weave back and forth from *a* to *j* to *i* to *b*.

Now as we progress upward and pass the 45-deg. mark, we find that the radial gage begins to serve more as a means of obtaining height than of lateral position. That function being already fulfilled by the regular height gage, we must find other means to set the remaining buttons horizontally. If we examine Fig. 3, we see how while the gage will register still nicely at the second or even third button, when carried to the fourth and fifth, the readings will be too crude, the disparity between the radius and the lateral dimension is too great. In fact, the graduations might mean infinity if carried to the 90-deg. mark. So we have to register by other means from a point of which we are certain.

This brings us to the most interesting part of the job. Glancing at Fig. 1 again, we see a dimension, marked *s*, diagonally across the upper part of the sketch. This reaches from button *b*, which is positively located in a horizontal direction to button *g*, which is in need of such location. Before going into the details of this step, it is well to observe here that once we have located button *g* horizontally we can readily get the horizontal location of button *f* by spacing it off with a Jo-block. Likewise buttons *d* and *c* may be located by repeating the same process in the upper left quadrant. This diagonal leap across is a sort of strategic move to get the advantage of the most positive diagonal measurement.

The setting was done with a 1-meter vernier caliper, which is rigid in its jaws and permits of 0.01 mm. measurements. The reading was gotten from the triangle *DEF* in Fig. 2. *EF* is simply dimension *x* minus *y*, while *DF* is the sum of *v* plus *w*. The hypotenuse *DE* therefore gives us our reading. The calipers were set at the reading plus the diameter of one button. Bringing the height gage and indicator into play to get the vertical setting, the button is moved along to what feels to be a setting within the jaws of the caliper. Then it is screwed tight. The caliper is set at 0.01 mm. less, and the setting is checked to see if the caliper fails to clear the button; then at 0.01 mm. more to make certain that the vernier does clear. As a further check, the special gage was swung around to this position to see whether it would read the required zero.

Once a quadrant was set, all the other quadrants were set on the same principle. The upper left quadrant used the same dimensions as the upper right, but for the two lower ones, different dimensions had to be figured out. The entire job did not take long to set up. All except two of the dimensions were given on the drawing, and these two required but simple arithmetic to compute. After boring out, the check-up was as simple as the original set-up.

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Magnesium Alloy Foundry Technique

The foundry technology of magnesium alloys presents no particular difficulties, according to L. B. Grant, at the recent Case Conference on Metals and Alloys, although it does introduce new problems. Chief among them is the great affinity between magnesium and oxygen at temperatures near and above the melting point of the metal. Best practice calls for a flux which permits melting in open cast steel pots. This flux not only protects the metal from burning, but also purifies it by removing non-metallic impurities.

Gating must be carefully controlled to exclude oxide skins and mechanically entrapped air from entering the castings. This is accomplished by the use of perforated metal skin gates and by long wedge gates. The extreme lightness of the metal calls for large risers.

When to Replace Equipment

The problem of investing profitably and economically the capital resources of any enterprise yields to a scientific mathematical analysis. An A.S.M.E. paper by H. O. Vorlander, Research Assistant, and F. E. Raymond, Associate Professor of Industrial Research, Massachusetts Institute of Technology, is abstracted below

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SINCE the advent of the present era of widespread mechanization of industry, industrial executives have been continually confronted with certain pertinent questions: What type of equipment is it best to install to perform a given task or service? When should existing equipment be replaced? How can the capital resources of the enterprise be most profitably employed so that all productive fixed assets in the business can not only pay for themselves in the shortest possible time but also earn an adequate return on the investment—how to protect the enterprise from the hazards of obsolescence? Answers to these questions were presented by the authors before the A.S.M.E. Dec. 2, in their paper, "Economic Life of Equipment."

Criteria for Determining an Equipment Policy

As a result of the present investigation, it has been found that there are certain definite periods of time in the life of any equipment, when measured from the date of its original installation, whose completion marks the instant that certain primary obligations have been fulfilled. When such corresponding criteria for alternative types of equipment are compared with each other they provide a measure of the relative state of economic utility that the most efficient type has achieved over the other.

1. *The True Accounting Life (H_t).* The prime requisite in all equipment problems is the time within which a given type of equipment can pay for itself. This criterion can be evaluated by equating the summation of all costs, expenses, and obligations for the proposed equipment, whether of positive or negative characteristics, to a similar summation for some standard basis of comparison when making an initial installation, or to a similar summation for the existing equipment when there seems to be an advantageous opportunity to replace it. In making such a comparison it is assumed that the above criterion is satisfied when there are no excess savings or when all savings over and above the costs incurred by other obligations are devoted to the depreciation of the initial or gross investment in the proposed equipment. This condition has been commonly termed the "break-even point." Since in this case there can be no further savings achieved, the time that it will take to accumulate in a reserve fund the original capital outlay or investment in the proposed equipment from yearly payments or allocation of assigned savings in lieu of depreciation will be the minimum time for the equipment to pay for itself, and as such it has been termed the "true accounting life." Accordingly, this criterion should be employed as the basis for all rational depreciation policies.

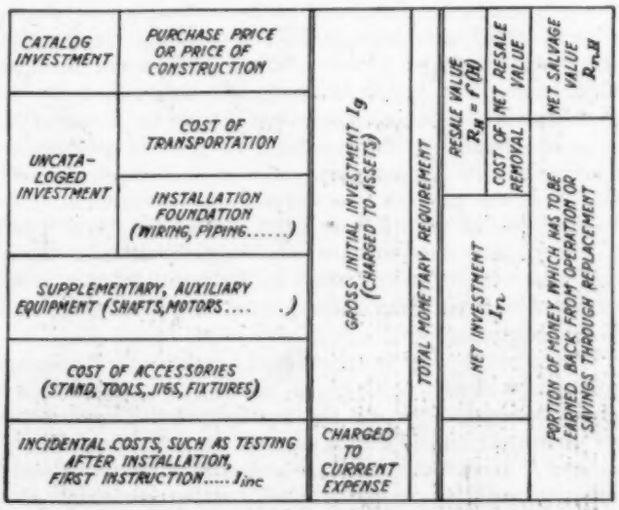
2. *The True Economic Life (H_r).* In the ordinary course of business it can never be assumed that any type of equipment has achieved a full state of economic utility when it has been able through its operation over a period of years merely to pay for itself, because there is the implied obligation upon all productive capital assets that they must in some manner pay back to the investor of that capital, whomsoever he may be, an adequate return as a reward for assuming the risks of business through his investment. Thus, in only satisfying the first criterion this second consideration will have been omitted. Accordingly the ultimate criterion for any equipment policy demands that not only shall the original investment be returned to its owner together with the normal cost for its use, but also an adequate return must be earned as well. The amount of this return will vary in all cases, and depends upon the profitableness of the industry and the ability of the management. The minimum return for any single unit of equipment will be determined by the average earning power of every dollar invested in productive assets. Accordingly the *minimum utility life (H_u)* of equipment will be that period of time which is required for any single equipment to fulfill all direct and implied obligations as outlined above.

However, this situation does not account for that which ultimately involves the relative economic utility of alternative types of equipment. In this case it is of primary importance to ascertain whether the proposed type of equipment can achieve an earning power equal to that of the present or existing type within a reasonable length of time. Of course if the relative economic superiority of the proposed type is so low that it cannot become at least as profitable to operate as the existing type before impending obsolescence occurs, there is little relative advantage in actually installing new equipment of that type. Furthermore there may be reason to ascertain whether the proposed type can enhance the earning power already realized from the present type, when the performance of both is projected into the future, so that a desired increase in the return can be obtained after a certain number of years of operation from the present have elapsed, or so that these savings can be transferred from the owners of the business to its customers in the form of lowered prices. All of this can be determined through an inspection of the relative trends of the curves for the functional rate of return (r_H) for both types of equipment over the desired number of years. This functional rate of return is a yearly rate factor dependent upon the total net savings available,

when computed for any definite number of years and averaged for the elapsed time, after all fixed and variable charges have been met. Now the ultimate time criterion for the relative economic utility of alternative types of equipment for the same task is measured by the period of time (H_r) required for the functional rate of return for one equipment to equal that for the other. Hence this time when these conditions are satified is termed the *true economic life.*

3. *The Critical or Minimum Life (H_s).* In contrast with the utility life and comparable with the true accounting life, there is a period of time when only a single unit of equipment is considered, at the end of which the accumulated margin between all obligations and the net revenue from the sale of the products produced or processed by the equipment is just equal to the original outlay of capital invested in the equipment with no consideration for the return expected on the investment. In other words, the equipment unaided by any outside considerations can just pay for itself in this minimum amount of time. Hence, in an emergency the equipment can be replaced at this moment without leaving any fixed obligations to be borne by the superseding equipment, although all of its obligations to earn any return whatsoever on its investment must be carried over into the future. This instant of time has been designated as the *critical or minimum accounting life.*

4. *The Serviceable Life.* In opposition to the various time criteria just discussed, which depend upon the performance of the equipment, there is the *serviceable life,* which is governed by the occurrence of obsolescence. Obsolescence is in most cases an uncertain factor, but it may be largely influenced by a more rational control over design change, or by the development of better production methods and processes, except where the whim of the customer influences the utility of the product or service and in turn influences the utility of the equipment employed in its porduction or performance. When an arbitrary accounting life is set there is always the risk that impending obsolescence will occur before that life has expired. The case is the same with the true life, but if the true life is shorter than the arbitrary one, which it often is, there is no need of running an undue risk of impairing capital resources irreparably through the occurrence of obsolescence before the equipment has paid for itself on the arbitrary basis. The risk of impending obsolescence can be measured by the ability to forecast future conditions, or in this case the probable rapidity and intensity of design change, and its relation to the true life. If the true accounting life or even the true economic life exceeds the apparent serviceable life, then the proposed machine is not sufficiently highly developed to justify its installation; that is, the increment in the transfer of skill to the machine is not great enough to warrant replacing the present equipment with that which is under consideration on the basis of anticipated economy of operation. If the true life approaches the supposed time for the occurrence of obsolescence or the serviceable life, but does not surpass it, then the interval of time between these two points when related to the true accounting life is the measure of the risk. The severest test is that between the critical life and the useful life when compared with the anticipated serviceable life.


CATALOG INVESTMENT
PURCHASE PRICE OR PRICE OF CONSTRUCTION
UNCATALOGED INVESTMENT
COST OF TRANSPORTATION
INSTALLATION FOUNDATION (WIRING, PIPING.....)
SUPPLEMENTARY, AUXILIARY EQUIPMENT (SHAFTS, MOTORS.... .)
COST OF ACCESSORIES (STAND, TOOLS, JIGS, FIXTURES)
INCIDENTAL COSTS, SUCH AS TESTING AFTER INSTALLATION, FIRST INSTRUCTION..... I_{inc}
GROSS INITIAL INVESTMENT I_g (CHARGED TO ASSETS)
CHARGED TO CURRENT EXPENSE
TOTAL MONETARY REQUIREMENT
RESALE VALUE $R_N = f'(N)$
COST OF REMOVAL
NET RESALE VALUE
NET SALVAGE VALUE R_{nN}
NET INVESTMENT I_n
PORTION OF MONEY WHICH HAS TO BE EARNED BACK FROM OPERATION OR SAVINGS THROUGH REPLACEMENT

ELEMENTS OF PRIME INVESTMENT

5. *The Physical Life (H_p).* Furthermore there is the *physical life* of the equipment, which depends upon the wear and tear from actual operation and deterioration of its substance. This life is the measure of the depletion of the physical characteristics and attributes of the equipment. Without maintenance the physical life may be short, so that maintenace in a sense is insurance against a too early depletion of the actual utility of service.

The Basis for an Equipment Policy

In the subsequent analysis from which these criteria have been derived, certain conclusions stand out as guiding principles to be followed in formulating an equipment policy and in evaluating the criteria which governs a particular situation. They are:

a. The capital resources of the enterprise must at all times be conserved, and the initial investment must at no time be impaired, for any cause, even impending obsolescence.

b. All equipment must be maintained in the most efficient state, and at least ready to operate.

c. An adequate return must be earned on the investment over and above the cost of capital, not only as a reward for risk, but also to provide some opportunity for growth either through earnings put back into the business or through the ability to attract new sources of capital whenever such funds are required.

d. Adequate provision must also be made for estimating and accounting for certain contingencies arising from the normal risks of doing business or the too sudden ocurrence of obsolescence.

e. In order to account properly for the nature, occurrence, and behavior of any and all direct or implied obligations, all comparisons and computations must be based

upon the total of the entire group over some definite or indefinite period of time. The comparison of annual costs has failed to reveal all the vital complexities of the problem.

f. Finally, since provision has been made in the original cost estimates for products to be produced or processed by the equipment, or established by the performance of equipment now in operation for the eventual fulfillment within a definite time of all obligations belonging to a specific type, all additional obligations must be paid for out of savings which can be achieved within the limits prescribed by these provisions and still within a reasonable time, as it is impossible to suppose that a reduction in the normal rate of return on the investment or an increase in selling prices will be permissible to offset any such increase in the total obligations incurred by a change in equipment.

Fundamental Considerations for the Evaluation of Equipment Policies

For practical purposes of comparison, out of all the formulas and methods proposed and employed heretofore, only two groups have been found worthy of attention. The first, which are recommended for use in determining policies for the selection and replacement of equipment, depend upon the total accumulated costs, expenses, and obligations for the entire anticipated life of both types under consideration. The second, which are applicable to the determination of the effect of an equipment policy upon the final cost of the product, depend upon the translation of all yearly costs to unit costs at the normal capacity of the equipment or some adjusted capacity equivalent to the current sales demand. The remainder of this paper will accordingly be devoted to the evolution of appropriate formulas and the development of practical techniques for daily use in industry. However, in order to avoid certain erroneous conclusions, the following injunctions must be observed.

a. One must assume that all types of equipment are identical as far as the general problem is concerned, and that in making any application of the technique all possible combinations of factors may be encountered.

b. To arrive at the correct solution of the problem, all comparisons employed must be fundamentally based upon equal amounts of service rendered by both types of equipment, with an additional provision for modifying this assumption only when the circumstances involve a change in the amount of service as well. If the comparison is made on the basis of unequal amounts of service, a false advantage is gained for one or the other piece of equipment which may or may not at some future time be realized.

c. Similarly all obligations which are dependent upon or vary with time must be reduced to a common or equivalent basis. This will be necessary when there is some future obligation which will occur in its entirety at some one specific time in advance and for which a provision for its eventual payment must be made each year prior to the time when the full obligation becomes due, in order that the eventual burden which it will place upon the economy of operation may be recognized and accounted for among those obligations which are a constant burden upon the equipment at the present time.

d. All comparisons of the cost characteristics of alternate types of equipment cannot be made to reveal the correct economic advantage of that type which is superior unless the resulting relationships are so formulated as to expose the differential between each individual cost characteristic for both types. Only in this way can the significant factors be exposed and those for which there is no relative advantage eliminated.

e. It must be recognized that the introduction of a new item of equipment will require a readjustment of the burden rates commonly employed in the distribution of overhead, and that a new method of allocating the burden of these items must be devised so as not to be unfair to either piece of equipment involved in the exchange. Even though the total overhead may not be changed, especially if those items which relate to the equipment are treated separately, the burden rates will have to be corrected because the use of the old ones in connection with the evaluation of the obligations of the new machine may not under the changed conditions account for the entire burden of overhead which must be distributed in full.

f. Depreciation must be based not on the gross initial investment but only on the out-of-pocket investment; that is, the difference between the gross investment and the net salvaged value which it is possible to anticipate at the time when the economic life of the equipment comes to an end, with due allowance for removal costs and similar changes, including any unamortized investment left over from previous types of equipment because of their replacement prior to the expiration of their true accounting life.

g. Finally, simplification of the resulting formulas and techniques must and can be made only when all elements of the problem are thoroughly revealed and understood. Equipment will vary in accordance with the service for which it is designed, and in no case will all of the elements of the problem apply to the same degree. Hence eventually separate formulas must be evolved for machine tools, jigs, and fixtures, and labor-saving devices or material-handling equipment.

The *prime investment* in a situation of replacement involves all cost from the time of the first consideration to the time of placing the equipment into useful operation. J. Chas. Fish in his "Engineering Economics" defines prime investment as the sum of the costs of investigation, promotion (financing, organizing), and construction or purchase and installation.

The investment obligations due to the installation of any piece of equipment are defined by the *gross investment* (I_g) of capital, the sources and ultimate disposition of which can be demonstrated by the accompanying chart.

Each situation requires a different set-up for the elements of prime investment. Other items must be considered, as, for example, cost of removal, cost or expenses for temporary equipment during the installation of main equipment, the purchase of patents and rights if in the nature of assets, the interest cost on capital tied up during the time of investigation, promotion, or purchase (installation) of equipment, loss of net income due to interruptions during period of installation, cost of accidents to persons employed in the installation, cost of accidents to equipment during time of installation, and similar contingencies.

That portion of the total outlay of capital, herein designated as *incidental costs* (I_{inc}), which is expended in the testing of equipment and the training of the operator is not ordinarily considered a part of the gross investment because it is an intangible non-recurring item and should be written off as an element of current expense. All cost incidental to the installation of new equipment is

usually charged to current expense or depreciated during the first year. Whatever the accounting method is in regard to such expenses, they should not be omitted in the equation for total accumulated cost (C_H) during the whole life. If such costs are debited to current or operating expense, they immediately lose their connection with the particular equipment under consideration; if they are charged off as depreciation during a shorter predetermined but arbitrary time, the result in the total-cost formula is in addition to the gross initial capital value. It is then obvious that the new equipment has to carry its own incidental expenses that must be earned back in some indeterminate time.

The main point is to know on just what portion of the prime investment interest and depreciation are to be paid, and upon which taxes are to be based. The second factor to determine is the sum of all capital costs incidental to the acquisition of the equipment. Owing to the prescribed basis for the computation of taxes, the ever-existing obligation to pay a cost for the use of capital resources and insure the equipment from all common hazards, the major purpose of depreciation in maintaining the original capital outlay intact and possibly the contractual obligation to pay royalties on patents which are specified on some arbitrary basis, there may be distinct differences in the items of investment employed in computing these various obligations. The cost of capital must be computed on that portion of the total outlay which is eventually to be capitalized as an asset and which normally is the gross investment I_g defined above. If on the other hand, the incidental costs I_{inc} are not to be written off in the first year but depreciated along with the gross investment I_g, then the cost of capital must be computed upon the basis of $I_g + I_{inc}$. Since there are legally prescribed methods of computing taxes, the basis for yearly tax payments will be different from the gross investment or even the book value; however, by means of appropriate coefficients the actual basis for tax computations can be related to the gross investment hence one must use $I_t = a \cdot I_g$. The basis for insurance will depend either upon the gross investment or the book value at the time of renewal of the policy, but it is conceivable that the actual premiums paid will not conform exactly to the payment of cost of capital. Here again an adjustment by means of coefficients will be required if the gross investment is to be employed as the actual basis for such computations. Since the funds set aside annually for a replacement reserve are only of such an amount as at the expiration of the economic life will equal the original outlay less funds received from resale (S_r) or salvage (S_v) plus any obligation (K) carried over from previous equipment, depreciation must be based on the summation of these investment factors which for any type of equipment will be expressed by $I_g + I_{inc} - S_v$ if the incidental costs are not written off in the first year. Finally, the payment of royalties may be based upon some arbitrary figure depending upon the particular advantage obtained from the use of patents or designs belonging to others; however, the basis of such payments can again be probably related to the gross investment by means of a suitable coefficient.

The remainder of the paper is devoted to a mathematical analysis of equipment life, which includes such factors as interest, depreciation, upkeep expense, space charges and time criteria of earning power. The authors develop a series of formulas which weigh the many variables in this complex problem.

Ambridge Test of Paints For Insides of Water Tanks

The Pittsburgh Des Moines Steel Company and the borough of Ambridge, Pa., which are jointly conducting an extensive test of paints for the interiors of water tanks, have announced the results of the second inspection of the 196 paint panels Nov. 16, 1931, after forty-two days' exposure. Following are the average ratings for various groups of paints into which the panels have been classified.

Classification	Average Rating For Class Per Cent
Red Lead and Linseed Oil Paints	89.0
Other Linseed Oil Paints	83.3
Synthetic Gum Vehicle Paints	72.3
Pyroxolin Base Paints	66.0
Gilsonite Asphalt Paints	80.5
Coal Tar Paints	86.3
Asphalt Emulsions (Plain)	91.5
Hot Bituminous Coatings	98.9
Thick Plastic Coatings	87.5
Elaterite Paints	86.8
Clear Varnish Finishes	87.1
Aluminum Paints	91.7
Miscellaneous Cold Bituminous Paints	77.0
Asphalt Emulsion and Filler	82.5

	Oct. 15, 1931 Per Cent	Nov. 16, 1931 Per Cent
Average Rating of Unclassified Panels	92.0	85.1
Average Rating of All Panels	94.6	83.3

A considerable number of the individual panels have deteriorated seriously but many are still apparently in about their original condition. The next inspection will be made Dec. 15, 1931.

Timely Resourcefulness

C. W. HINMAN
Chief Tool Designer, Kobzy Tool Company

If a man is naturally resourceful, this trait appears in him more often when some difficult problem is pushing him hard.

I recall the case of a young man who carried the title of master mechanic in a small shop where I was connected many years ago. This young man had ordered ten thousand No. 2 56 x ¼-in. oval head steel screws, and by some exasperating error of his, these screws when completed were between 0.005 and 0.008 in. too large.

This young master mechanic was resourceful, and our superintendent knew it. He was called "on the carpet," and informed that unless he found some way to correct his error, he would have to go. "All right," the young man replied, "By three o'clock this afternoon, I will have every one of those screws down to the right size." The time was then near the noon bell, and the superintendent appeared incredulous.

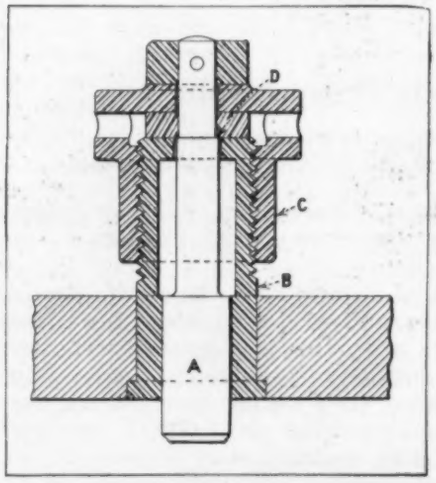
True to his promise the master mechanic brought in the entire order of screws to the superintendent, and handed him a micrometer for a test. Every screw was right to size. It appeared that he had gone at once to the nickel plating department, and by the help of another man, had "sweated" the screws to size, a small handful at a time, by putting them in a glazed basket of fine mesh, swaying them in a tank of treated sulphuric acid, then in water, and testing them with a micrometer until each batch was right. Of course the threads were not perfect, as the acid attacked the points of the threads more rapidly that the root diameters, but every one of them was used successfully without any trouble.

Ideas from PRACTICAL MEN

A Screw-Operated Index Pin

CHARLES C. TOMNEY
Chief Tool Designer, Brunswick-Kroeschell Company

An indexing fixture for boring twin cylinders was designed so it could be used either on a vertical boring mill or on a turret lathe. To meet these conditions, it was necessary to keep the base smaller than if the fixture were to be used on the boring mill only. Also it was decided to counterbalance the fixture. The smallness of the base made it inconvenient to use an index pin, operated by a spring, because the spring would have to be stiff, and there was not room enough for the usual operating lever.



The indexing pin used is shown at *A* in the illustration. It is 1 in. in diameter and is a nice fit in the threaded bushing *B*, which is forced into the base of the work-holding part of the fixture from below. The upper part of the pin is of two diameters, $\frac{5}{8}$ and $\frac{9}{16}$ in., respectively, the $\frac{5}{8}$-in. diameter fitting the upper end of the bushing. The steel nut *C* is a loose fit on the threads of the bushing, and its upper part is a loose fit on the $\frac{9}{16}$-in. part of the pin. A steel collar, a nice fit on the upper part of the pin, is placed under the top of the nut and rests on the shoulder of the $\frac{5}{8}$-in. part of the pin. Another steel collar is pinned to the top of the pin, over the nut. Four $\frac{3}{4}$-in. holes in the upper part of the nut make provision for the use of either a spanner wrench or a tommy bar for turning it.

The Acme threads on the bushing and in the nut are $\frac{1}{8}$-in. pitch, quadruple, having $\frac{1}{2}$-in. lead, so it is necessary to give the nut $1\frac{1}{2}$ turns to pull the pin out of the stationary part of the base. In raising the pin, the top of the nut bears against the upper collar, and in lowering, its under side bears against the lower collar, which in turn bears against the shoulder *D*. We think this pin is the best type to use on heavy fixtures because it is positive. Where an extra-large pin is advisable, gear teeth can be cut on the nut and a handwheel and a pinion used to raise and lower the pin.

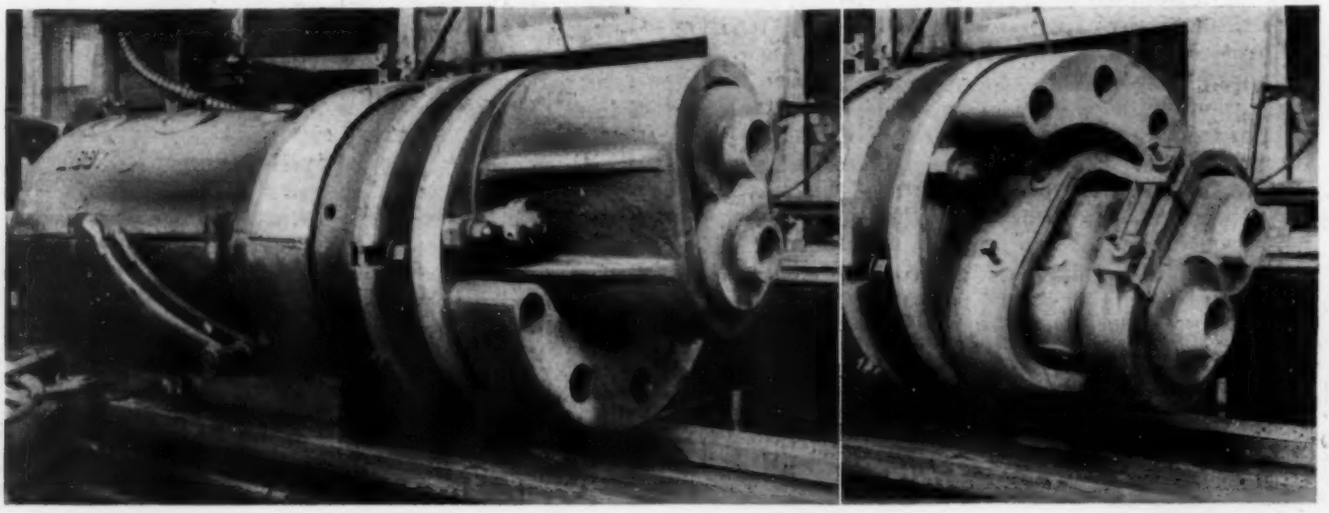
The photographs show the fixture set-up for boring both holes. The index pin may be seen in the view at the left.

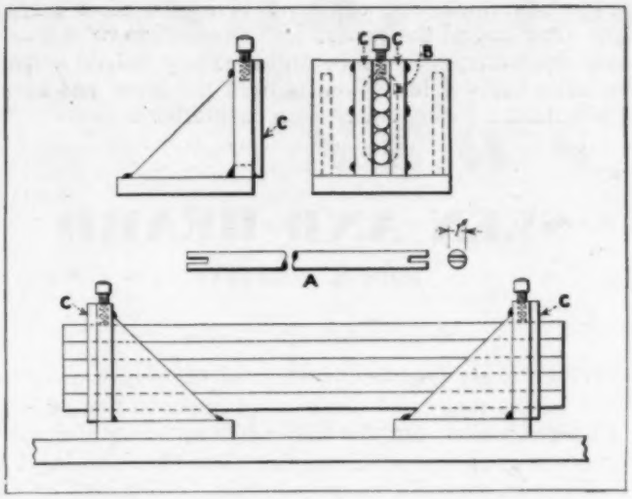
Slotting the Ends of Shafts

CHARLES KUGLER

A small shop took a contract for slotting both ends of a large quantity of 1-in. shafts, such as the one shown at *A* in the illustration, the slots to be in the same plane. After spending considerable time in various ways, attempting to do the work without fixtures, it was decided to make the inexpensive fixtures illustrated.

Two angle plates were made of cold-rolled steel by welding plates together. Clearance slots *B* were cut in the vertical members of the angle plates by means of a gas torch. As guides for the shafts, strips *C* were welded to the angle plates on each side of the slots. There was no machine work done other than to drill and tap for





the clamping screws. Since no tongues were placed in the bases of the angle plates, they were aligned on the milling machine table by an indicator held on an arbor.

The shafts were stacked five-high in the slots of the fixture, being held in vertical alignment by the strips on each side, so that all the shafts could be slotted at one setting. Slotting was done at one end by raising the knee, after which the knee was lowered and the table was traversed to bring the opposite ends of the shafts into cutting position. These ends were slotted by again raising the knee and bringing their ends into contact with the cutter.

Portable Swaging Machine

FRANK C. HUDSON

Compressed air has for many years been utilized in various ways in railroad shops. The small swaging device shown is used in the Roanoke shops and consists of an air hammer mounted in a block that acts as a frame and holds an anvil. The block is clamped in a vise and the hammer is operated by a wire from the trigger to the foot treadle. The hammer is used for swaging small pins. The foot treadle allows the operator free use of both hands.

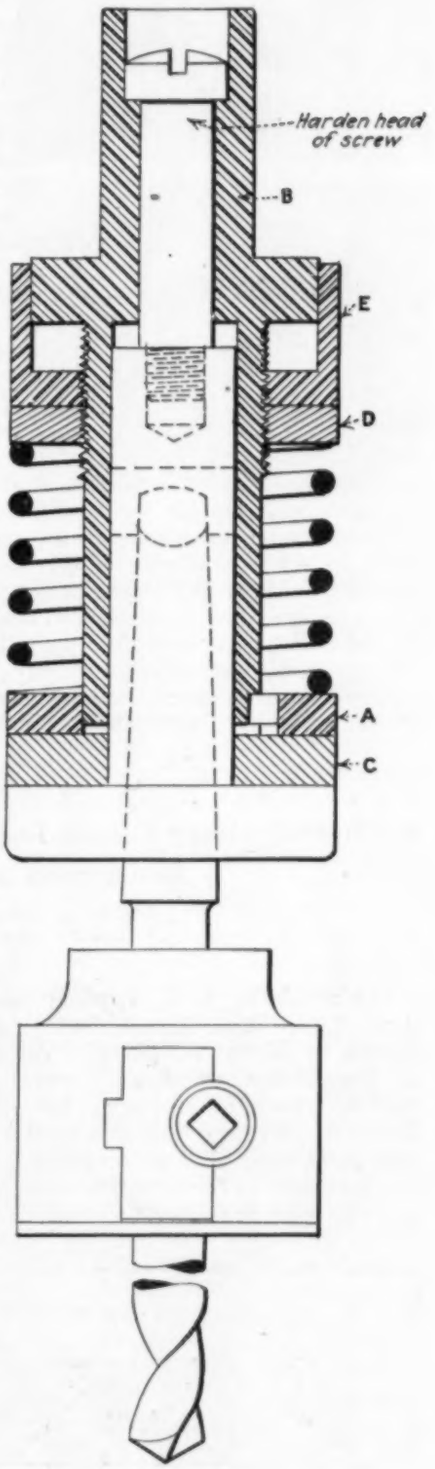
Similar adaptations can be made to handle a wide variety of work. Light, special forgings can be made in this way and special punching can also be done when a regular punch press is not available. In case such a device is used but little, the hammer can be removed for use in other ways until needed on these special jobs. The set-up cost but little and is a real time saver.

Drill Holder for Deep Drilling—*Discussion*

HENRY W. BOEHLY

In an article under the title given above (*AM*—Vol. 75, page 318), John B. Walsh describes a drill holder that is a good tool. Its outstanding features are safety for the operator, efficiency, and economy. I am referring only to the basic idea of the device.

This tool reminds me of a friction device that I suggested when I was an apprentice. I had to drill out the cores of a lot of dies, leaving the contours of the holes to be finished by filing. Sometimes, the dies were as much as 3 in. thick, and in some cases, as many as 200 holes had to be drilled in a single die. Since the steel was hard, many drills were broken. Once, at a critical moment, I noticed that the belt, which was rather loose, slipped on the pulley and thereby saved the drill from breaking. It was then that I suggested the device shown.

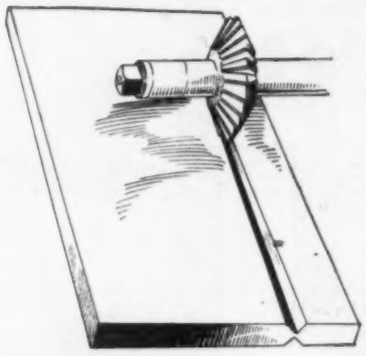


The collar *A* is keyed to the sleeve *B* and presses against the fiber washer *C*, pressure being supplied by a heavy spring. The pressure can be adjusted by screwing the threaded collar *D* up or down, locking it by the special nut *E*. The pressure required to drive a drill of a certain size is found by trial, screwing the threaded collar up or down just enough to let the collar *A* slip on the fiber washer.

A Small-Shop Kink

CHARLES H. WILLEY
Superintendent of Manufacturing,
Hoyt Electrical Instrument Works

Recently we had to cut an inch from the width of a dozen ⅜x12x15-in. steel plates, since an error had been made when they were ordered. The plates were needed in a hurry. Since neither power shears nor a cutting torch were available in this small town in our hour of need, and our power hacksaw would not fill the bill, we tackled the job in the manner described below.



At first, we tried to cut off the piece not wanted by the common method of drilling a row of holes close together, but found it too slow. Then we strapped a plate on the milling-machine table and tried cutting off the piece with a slitting saw. While this was faster than drilling, the cutter would persist in digging in and was in danger of having the teeth broken, because the machine was light and we had no means of supporting the outboard end of the arbor. Next, we tried cutting off the piece in the shaper, using a regular cutting-off tool, but the tool would dig in and break.

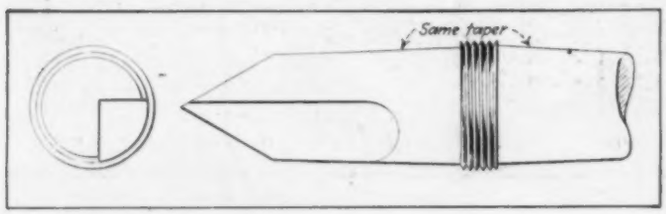
Finally, one of the boys suggested using a double-angle cutter of 60 deg. in the milling machine and milling from each side of the plate, leaving a ⅛-in. web in the center (as indicated in the sketch) and then breaking off the piece with a hammer, the edge to be squared with an end mill. This method saved the day, 30 min. only being required for each plate. Perhaps there is an easier way to do this job in a shop equipped only with light tools.

A Three-Quarter Center for the Tailstock
Discussion

FRANCIS W. SHAW
Tool and Gear Consultant
Heywood, England

The article by J. T. Towlson under the title given above (*AM*—Vol. 73, page 446), and the discussion thereon by Henry W. Boehly (Vol. 74, page 217), remind me of my own shop experience.

If the center is milled out in the way suggested by the sketch, it will be but little weakened and can be reground time after time without removing material other than that necessary to conserve the cone. Tapering both ends of a center to fit the tailstock spindle is a convenience in production work, and can be of value in other ways. The inner end of the center, for instance, can be utilized as a cup center, or it can be drilled axially to hold a drill or other tool. I have even utilized the inner end as a T-slot mill, a facing cutter, or a counterbore.



SEEN AND HEARD

JOHN R. GODFREY

Non-Refillable Bottles

It's a far cry from the old plea of the glass blower to have bottles that could not be used again to non-repairable automobiles, but the latter is now being seriously proposed as an economic measure. The idea is to build a 30,000 mile car with no adjustments on bearings or on much of anything except brakes, and junk the car when repairing becomes necessary. The plan is worth considering for more mechanisms than automobiles. The cost of repairing many small machines is all out of proportion to the first cost of making it and the customer is naturally aggrieved at the bill. Anyone objects to paying $2 for having a $1 watch cleaned and adjusted yet it may easily cost $2 in labor in the hands of a skilled watchmaker. It is obviously cheaper to buy a new watch. Perhaps this same thing may apply to some machines.

Closer Limits With T-C Tools

One of our observing shop executives feels that a wider use of tungsten-carbide tools is sure to come as the result of the demand for closer limits. The greatly decreased wear on T-C tools makes it possible to hold sizes more easily. Then too there is a tendency to use harder metals in some cases. One motor builder, for example, is using a piston with 30 per cent silicon which is so hard that only T-C tools can handle it.

Steel is still a stumbling block with some in the use of T-C tools because of the tendency to fuse with the steel and so build up the edge. The use of tantalum in the alloy is said to lessen this tendency. On the other hand we find some large shops successfully using T-C tools on steel, which brings up the question of ignorance of the proper method rather than a fault inherent with the tools.

One-Way Sponges

Sponges absorb great quanties of water. Unsqueezed they might easily keep a lot of H_2O out of circulation except for evaporation or leakage. Some shop managements seem to work with a one-way sponge philosophy; they absorb all the informaiton possible from the experience of others but balk at swapping any ideas that might even remotely help a competitor.

One shop that comes to mind has an ironclad rule forbidding the publication of any of its tools or methods. Yet the same shop takes several publications in its field and routes them to various production executives.

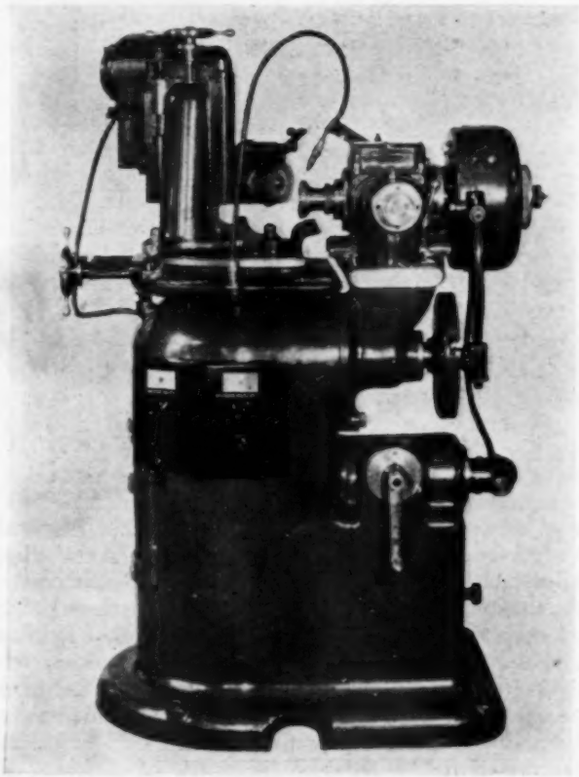
Actually, there are few cases where clever shop methods are or can be directly copied to advantage. They more often suggest adaptations that fit entirely different products and so add to the general fund of shop knowledge and help to maintain our world position as leaders in machine production.

SHOP EQUIPMENT NEWS

National-Cleveland Radial Helicoid Grinding Machine

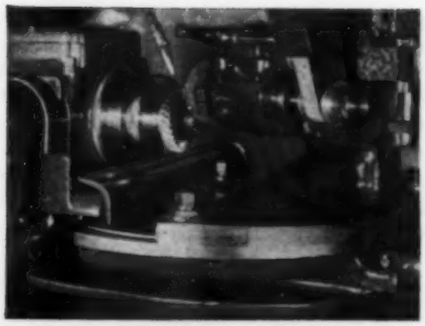
A radial helicoid grinding machine especially adapted for sharpening staggered-tooth helical gear-shaper cutters has been introduced by the National Tool Co., Cleveland, Ohio. The machine is fully ball bearing mounted, spindles and other shafts are of alloy steel hardened and ground, and the index head sleeve, work spindle and index spindle, together with the grinding wheel spindle, are lapped after seasoning.

A radial helicoid may be said to be the side wall of a square thread cut in a shaft. Best cutting action of a radial helicoid cutter is obtained when the cutting faces are also radial helicoids. This grinding machine has, therefore, been adapted for producing a radial helicoid cutting face on staggered-tooth helical gear-shaper cutters. It is self-contained and fully automatic, except for loading and unloading. Driving motor, coolant pump, and coolant tank are mounted in the base, the flexible coolant hose passing through the top of the machine frame. The machine and grinding wheel switches are grouped in an easily accessible position. A reversing switch, provided to reverse the direction of grinding wheel rotation, is unusual in having "right-hand" and "left-hand" lettered on the toggle to prevent error. Right-hand and left-hand grinding wheel clamping nuts are furnished to prevent loosening of the nut under reversed wheel rotation.



Control switches are at left, the motor, coolant tanks and coolant pump being within the base

The motor for driving the grinding wheel, shown at the highest point in the illustrations, is mounted on a vertical slide which carries the grinding wheel quill. Cup grinding wheels of the largest possible size are used. Factors governing this size are obviously the cutter diameter and helix angle. A cutter of around 4-in. pitch diameter and 30-deg. helix angle permits a 4-in. cup wheel to be used. The helical angle selected in the cutter is usually the helix angle at the pitch line. Given also the pitch diameter of the cutter, the lead of the radial helicoid cutting face can be computed.



Closeup of the cutter and wheel mountings, showing the vernier and scale for setting the wheelhead. Below, the easily-changed helical guides

To enable the axis of the grinding wheel quill to be placed at the pitch line of the cutter, a scale and vernier have been provided at the side of the cutter slide. The face of the grinding wheel should be dressed with a diamond so that there will be a line grinding edge, therefore a diamond truing device has been provided. Truing may also be done with a carborundum stick, the inside of the wheel being dressed by hand.

A swivelling grinding wheel head carries the grinding wheel slide. It can be swivelled directly to the helix angle of the cutter, readings being taken on a vernier coacting with degree graduations on the base which carries the head. This base slides on ways integral with the water pan, which is securely mounted on the top of the machine frame. The slide enables the grinding wheel to be moved by means of a handwheel in positioning it with respect to the work.

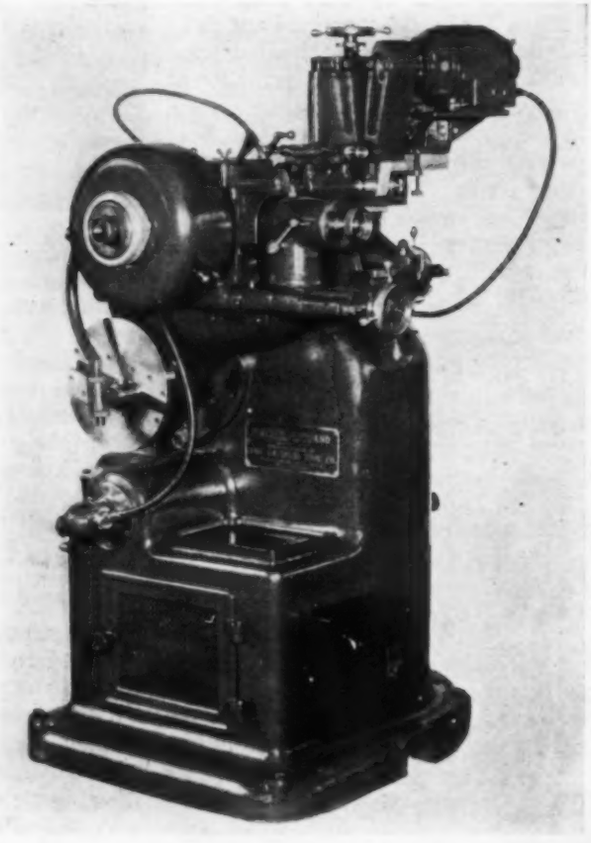
Inasmuch as gear cutters of the

staggered-tooth type are provided with a multiple number of teeth, an automatic index head identical with that used on National-Cleveland gear grinding machines has been provided. Indexing of cutters from tooth to tooth must of necessity take place when the cutter is out of contact with the grinding wheel. This machine is so arranged that the rotary and linear movement necessary in sharpening are combined in the cutter. Rotary movement results from the crank disk seen at left in one of the illustrations of the machine and at right in the other. A connecting rod transmits the reciprocating motion to the outer portion of the automatic indexing head, giving it a rotary oscillating movement. This movement may be made at any desired speed, governed of course by the ability of the grinding wheel to cut the metal, and rotates the cutter one way for a portion of a turn, then back for the remainder.

Helical guides securely fastened to the outer sleeve of the work spindle provide linear movement of the work. Contacting with the side walls of these helical guides are rollers mounted on stub shafts carried by the tailstock spindle. These rollers are adjustable to be moved toward or away from the axis of the work spindle by means of the conventional screw and handwheel, and can thus be adjusted for bearing on the helical guide sidewalls. These helical guides are really a portion of the thread, that is a section of a worm thread having angularly disposed side walls with respect to the axis. This taper in the side walls provides for the adjustment of the rollers, which are similarly tapered.

Indexing, to occur at the proper time, must be shifted to the opposite end of the cycle to care for cutters of opposite hand. This is accomplished by changing the position of the connecting rod on the crank disk which provides oscillating motion to the indexing head. The face of the disk is stamped with the necessary information for changing. Further, a right-hand cutter must be provided with a left-hand radial helicoid cutting face, while a left-hand cutter must have a right-hand cutting face, hence double sets of helical guides are provided. They are easily changed by removing the casing cover and loosening two headless setscrews.

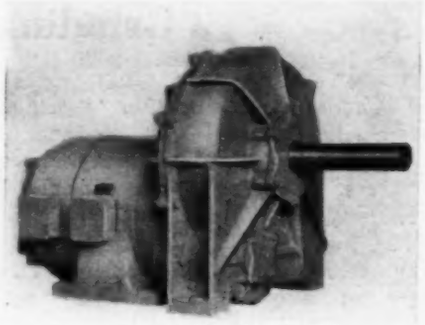
The crank disk gives oscillating motion to the cutter head, while the top-mounted motor drives the grinding wheel through a flat belt. The switch at its base reverses it



The tailstocks are carried on a slide mounted on a bracket fixed to the bed frame. The slide is adjustable by means of a handwheel, the magnitude of adjustment being read on a scale. This adjustment is likewise necessary when changing from right- to left-hand cutters and vice versa. These positions may be tabulated and shown on a chart for ready reference of the operator. The machine is of full ball-bearing construction.

Sterling "Slo-Speed" Motors

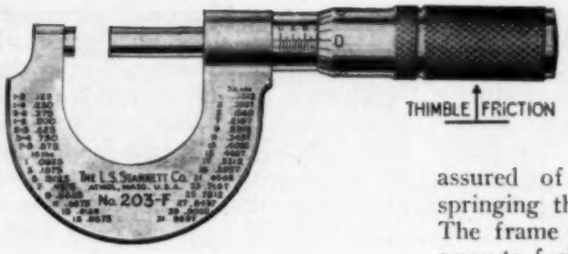
"Slo-Speed" motors, offered by the Sterling Electric Motors, Inc., Telegraph Road at Atlantic Blvd., Los Angeles, Calif., comprise the company's standard motors, the speed of which is reduced to a suitable low value by means of totally inclosed,



single, double and triple helical or herringbone gears built into the motor frame. The gear wheels and pinions are of the stub-tooth type, and are made of special chrome-nickel steel. Thrust loads of the gear are arranged to equalize each other where more than one reduction is used. The housing is heavily ribbed and double oil seals are provided on the incoming rotor and outgoing power shafts. Speed increasers are also available for speeds up to 6,000 r.p.m. Both the Slo-Speed and speed increaser units can be built on three-phase, squirrel-cage, slip ring, high-torque, 2-, 3- or 4-speed motors. Geared heads can be put on both ends of the motor to provide two slow and different speeds, if desired. In most cases the gear bracket can be rotated 90 deg. or more.

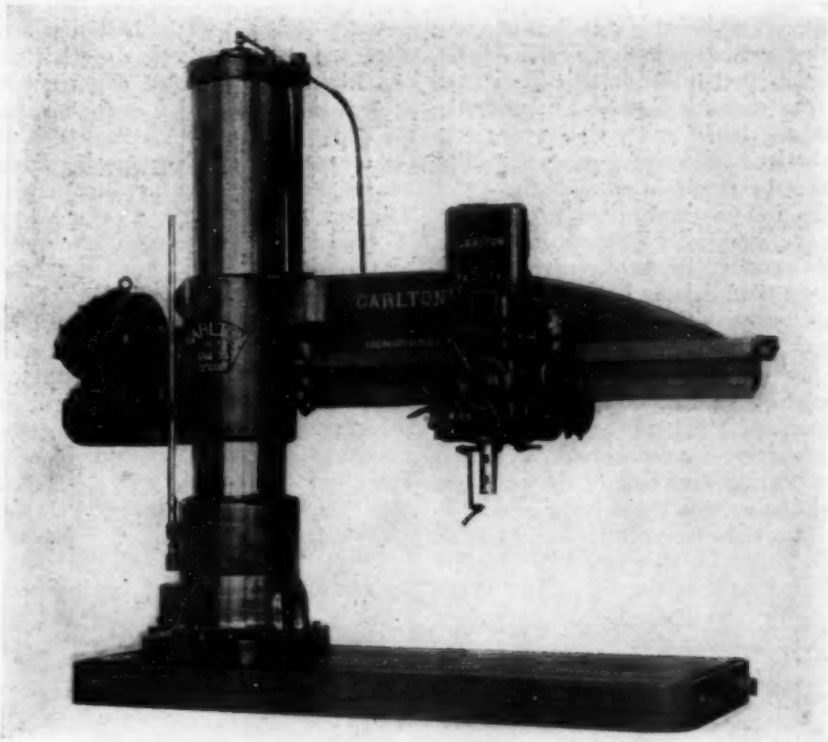
Starrett Thimble-Friction Micrometer Caliper

A friction-stop mechanism embodied in the thimble is the outstanding feature of the No. 203F micrometer caliper announced by the L. S. Starrett Co., Athol, Mass. This arrangement eliminates the inconvenience of reaching beyond the thimble to operate the stop. The micrometer is easier to use with one hand and speeds up the work of checking on any job where frequent measurements are necessary.



The thimble is made up of two parts, the section near the frame being connected directly to the spindle, the other section controlling the friction stop. Since the stop disengages at exactly the same pressure each time, the operator is assured of uniform contacts, and springing the instrument is avoided. The frame of the micrometer is cut away to facilitate use in places where ordinary frames cannot be inserted. The range of the instrument is 0 to 1 in. by thousandths or, for an extra charge, by ten-thousandths.

Carlton 22-In. Column Radial Drilling Machine



A welded steel base is employed in the 22-in. column radial drill built by The Carlton Machine Tool Co., Cincinnati, Ohio, with 7, 8, 9 and 10 ft. arms. This machine is of the company's standard design, but is proportionately larger. It is built on the unit principle and equipped with ball bearings throughout. All gears are heat-treated and run in oil. Shafts are hobbed from the solid, and the holes are broached with multiple broaches to fit the shafts.

This machine has a low hung drive, which is brought down underneath the arm and drives the largest diameter of the spindle close to the work. The machine is mounted on an all-welded steel base made from 0.20 to 0.30 carbon steel plates, which give approximately 20 per cent more rigidity than a cast-iron base of heavier pattern. The top of the base is made from a 3-in. plate. Heavy ribs are welded to the plates and also a heavy plate is welded to the bottom, making a complete box section.

This radial drill can be furnished with a cutting lubricant outfit, an electric hydraulic column binder, power rapid traverse of the head, and with any style table. It can be equipped with either a.c. or d.c. motors. The machine illustrated is equipped with an adjustable-speed motor drive and with a rheostat control mounted in the head.

In design, the machine has been made to take care of the largest and heaviest work required of a radial drill, much of which was formerly done on large heavy-duty boring mills. A range of speeds is provided to drive small twist drills at the maximum speed. Rigidity has been embodied to take care of the use of the carbide cutting tools.

Haskins Foot-Operated Type Electric Screw Driver and Nut Setter

In extending the scope of mountings for the Haskins standard screw driving and nut setting units *(AM* —Vol. 74, p. 376) the R. G. Haskins Co., 4636 W. Fulton St., Chicago, has added a foot-operated mounting. Where it is possible to bring the work to the machine, this type of mounting will meet many requirements. As

Fig. 1—Bench model of Haskins Foot-Operated Type Electric Screw Driver, and Nut Setter

the unit is operated with the foot, both of the operator's hands are free to assemble the parts.

The standard power unit includes a split-phase, induction-type, constant moderate speed motor with a single gear reduction. By means of a clutch, which is independent of the torque device, the bit revolves only at the time the screw or nut is driven, thereby preventing marring the screw slot and the danger of exposed revolving parts. The unit is counterbalanced and so poised that it operates without tiring effect on the operator and yet gives perfect control.

A substantial casting constitutes the frame that incloses the counterweight and provides two liberal bearings for the vertical sliding seamless steel tube supporting the head. The power head is attached to the vertical shaft by means of a cast aluminum bracket terminating in a split clamping ring surrounding the motor casing. Accessible stop collars provide ready adjustment of the vertical stroke.

Fig. 2 — Haskins Foot-Operated Screw Driving and Nut Setting Unit with pedestal base and foot control

Fig. 1 illustrates the bench type. The treadle is a self-contained unit and does not require fastening to the floor, but is suspended from the bench by means of the four machine bolts that secure the frame to the bench. Adjustment of the treadle bracket is available for different heights of benches, and the treadle can be quickly adjusted and locked to suit operating conditions and the maximum convenience of the operator.

The machine shown in Fig. 2 is of the same general construction as the bench type, with the exception that it is mounted on a cast-iron pedestal base. An adjustable table is attached to the pedestal, and it has a wide range of vertical adjustments to conform with different heights of work.

Rafter Press Brake

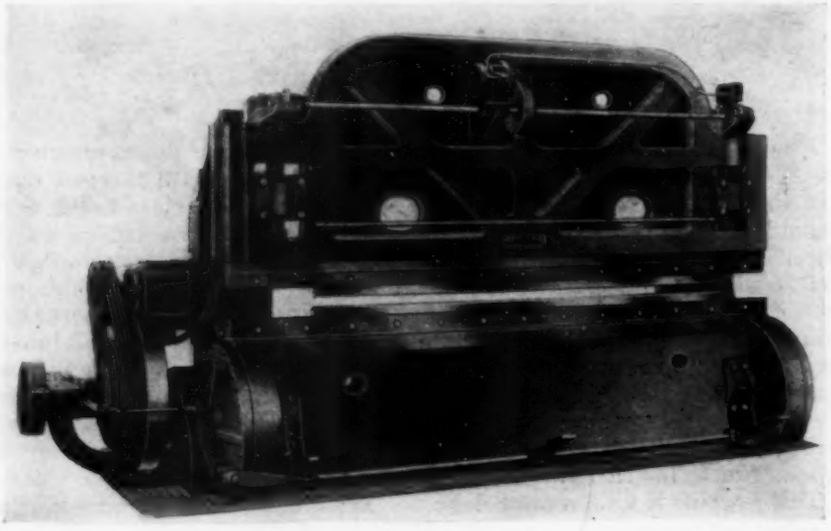
The Farrel-Birmingham Co., Inc., Ansonia, Conn., is now manufacturing the Rafter press brake as sole licensee. The machine was formerly manufactured by the Rafter Machine Co., Belleville, N. J. In the Rafter design, the power is applied from below so that the ram is pulled into the work. The drive is attached or contained within the base, and there is no driving mechanism on the upper part of the machine. Over-all height is thus shortened and less headroom is required. The driving gears are fully inclosed and run in an oil bath.

Motion is transmitted to the ram by two special, C-shaped connecting rods actuated by an eccentric located within the base. These connecting rods are considerably longer than the usual connections, and exert practically a straight down pull. Side thrust of the ram on the gibs is thus minimized. These eccentric shafts are carried in three large bearings, one bearing each side of the eccentric and one outside the driving gear.

Ram adjusting screws are hung in the ram, or, in other words, are rigidly secured only at the top. The lower end of the screw fits into a recess in the ram, which provides a guide for the end of the screw and prevents side motion. Trunnion nuts always have the same number of threads in contact with the screw, regardless of the amount of die opening.

The uprights guiding the ram are securely fastened to the base and are employed only to keep the ram in alignment with the base. The ram is deeper, not only in the center but on the ends, to give stiffness and also to permit the use of longer guides. Side housings and a crown are eliminated. The machine is mounted on a heavy A-shaped base requiring no foundation other than a flat bed of concrete. The brake is an open-throat machine, permitting the utilization of the dies for the full length of the ram and base, instead of only the amount of clearance between the housings or uprights. For work that must be passed through the machine, ample space is provided in the rear. Rolled steel plates, fabricated by welding, are used for the brake.

Drive is furnished from the motor by multiple V-belts to the flywheel.

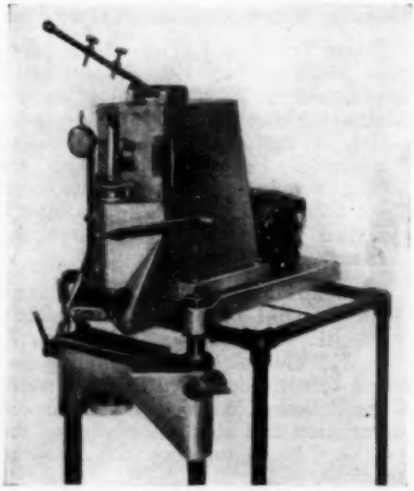


The drive shaft and flywheel are equipped with roller bearings. The friction clutch is electrically controlled by push buttons operated either by hand or foot. A lubricating system provides lubricant to all bearings.

The quick-release dieholder is a feature. By simply loosening the bolts on the two clamping members holding the die, the die is permitted to drop, and the work can be removed without damage to the die or to the machine. Sizes up to 300 tons capacity are carried in stock and larger sizes of the brake are made to order.

"Grade-O-Meter" Grinding-Wheel Testing Instrument

The Grade-O-Meter, announced by the Abrasive Engineering Corp., Div. of Simonds Saw & Steel Co., 2842 West Grand Blvd., Detroit, Mich., is an instrument for mechanically testing the strength of the bond of grinding wheels, honing stones, grinding



segments, emery blocks and other abrasive products. The instrument substitutes a scientific method for testing the strength of the bond as contrasted to the usual hand method employed in shops. The apparatus can be used to grade, classify or standardize various kinds of grinding wheels and indicate from definite units the true grade and also the variation in grade at different points on the same wheel. Thus, questions in the shop as to the proper grade of grinding wheels required for various operations can be solved correctly.

The Grade-O-Meter Type L occupies 8 sq.ft. of floor space, weighs 855 lb. complete, and is mounted on casters to make it readily portable. It has a ball-bearing table and a capacity to handle all wheels up to 50 in. in diameter and 12 in. thick, the table elevation being 26 in. The Type S occupies 4 sq.ft. of floor space, weighs 163 lb., and is mounted on large ball-bearing casters.

Logan Hydraulic Power Unit

An hydraulic power unit suitable for operating chucks, work-holding fixtures, clamps, hoists and the like is being offered by the Logansport Machine Co., Logansport, Ind. It is pictured applied to a Logan 3-jaw universal hydraulic chuck on a turret lathe. Pressure range is from 50 to 200 lb. per sq.in., and is adjustable through a regulating valve.

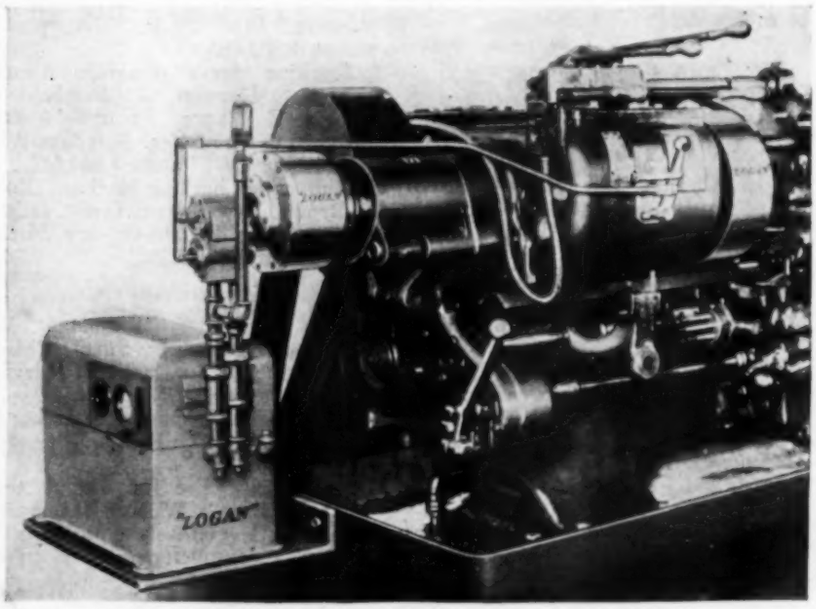
In brief, the unit consists of a motor-driven, constant-delivery, internal gear pump, a spring-loaded accumulator, a pressure regulator and a pressure switch. Accumulator pressure is from 225 to 275 lb. per sq.in. and is always above the maximum pressure at the regulating valve. When a pressure of 275 lb. is built up in the accumulator, the motor is cut out automatically; when the pressure drops to 225 lb. the motor is cut in again, building the pressure up to 275 lb. Through this method of pressure control there is no by-passing of oil, with consequent loss of efficiency.

All these units are inclosed in a compact case, exposing a panel board on which is mounted an "on" and "off" motor switch, pressure gage, and an oil level gage actuated by a cork float in the reservoir, which is the base of the case. In the turret lathe application pictured, the hydraulic hand-control valve is an integral part of the chuck cylinder, thus simplifying the piping arrangement considerably. Operation time of the chuck is 1½ seconds. Constant pressure is on the work at all times, maintaining full gripping pressure during the machining operation.

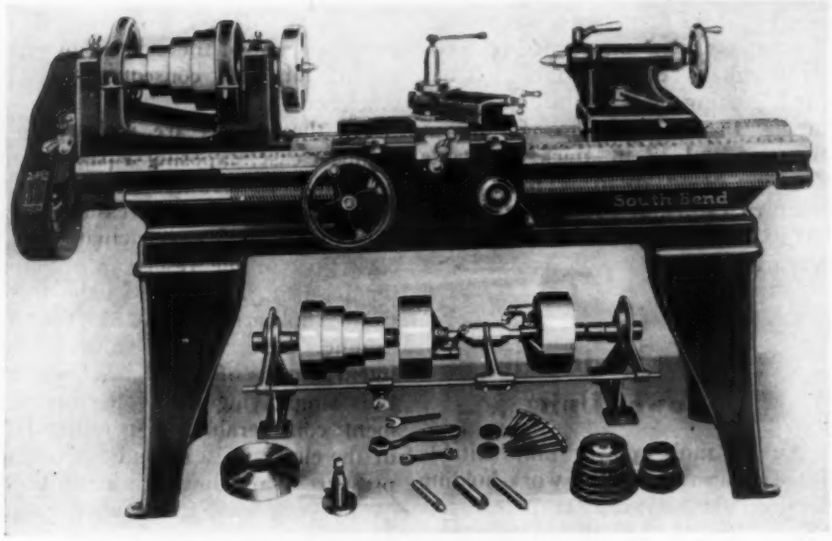
South Bend 16-In. Junior Engine Lathe

A general-purpose 16-in. junior lathe designed for light manufacturing and general machine shop and maintenance work has been added to its line by the South Bend Lathe Works, South Bend, Ind. The bed lengths available are from 6 to 12 ft. Simplification in construction and design has resulted in a lathe which has been relieved of non-essential, expensive features not needed in general machine shop work.

The lathe is a back-geared, screw



Logan Hydraulic Power Unit applied to a Logan hydraulic chuck on a turret lathe



South Bend 16-in. Junior Engine Lathe of simplified construction for general shop work

cutting type with automatic longitudinal feed and eight changes of spindle speed. All standard screw threads may be cut, from 2 to 40 per in., right or left hand, including 11½ pipe thread. The headstock spindle is made of special carbon steel, with a 1⅝-in. hole through.

Bearings are of phosphor bronze and are adjustable for wear. The tailstock has a set-over for taper turning, a graduated spindle, improved binding plugs, and a hardened center. The compound rest will swivel to any angle and has an angular travel of 3¾ in. The lathe may be had in a countershaft drive or in various types of motor drive.

PATENTS

Metal Working Machinery

Ring Rolling Machine. James Hall Taylor, Chicago, Ill. Patent 1,832,881.

Apparatus for Machining Surfaces. Milton L. Turner, Augusta, Me. Patent 1,832,923.

Nut Tapping Machine. Lewis A. Safford, Buffalo, N. Y., assigned to Automatic Nut-Thread Corporation. Patent 1,833,182.

Chain Welding Machine. Earl A. Stuller, Cleveland, Ohio, assigned to The Cleveland Chain and Manufacturing Co. Patent 1,833,444.

Center Drive Lathe. Elmer F. Batterman and Josef Verderber, Cleveland, Ohio. Patent 1,833,601.

Tail Stock. Elmer F. Batterman, East Cleveland, and Joseph Verderber, Cleveland, Ohio, assigned to The Cleveland Universal Jig Co. Patent 1,833,602.

Material Forming Apparatus. Charles Edwin Nelson, Chicago, Ill., and James F. Pullan, Pawtucket, R. I., assigned to Western Electric Company, Incorporated. Patents 1,833,656, 1,833,657, 1,833,658.

Ejecting Mechanism. Alfred G. Ravenschlag, Chicago, and Francis P. Tikalsky, La Grange, Ill., assigned to Western Electric Co. Incorporated. Patent 1,833,659.

Welding Apparatus. Claude Theodore Siebs, Cranwood, N. J., and Thomas Archie Daniel, Maywood, Ill., assigned to Western Electric Co. Incorporated. Patent 1,833,660.

Apparatus for Handling Articles. John S. Stull, Chicago, Ill., assigned to Western Electric Co. Incorporated. Patent 1,833,662.

Die Casting Machine. Francis P. Tikalsky, La Grange, Ill., assigned to Western Electric Co. Incorporated. Patent 1,833,663.

Machine for Trimming Abrasive Wheels. Hermon G. Weinland and George E. Vance, Springfield, Ohio, assigned to The Safety Grinding Wheel & Machine Co. Patent 1,833,667.

Automatic Chucking Machine. Robert S. Brown, New Britain, Conn., assigned to The New Britain-Gridley Machine Co. Patent 1,833,822.

Tools and Attachments

Gage Structure. William P. Watling and Bernard F. Small, Chicago, Ill., assigned to International Harvester Co. Patent 1,832,953.

Grinding Attachment for Milling Machines. George C. Reid, Easley, S. C. Patent 1,832,997.

Progressive Die for Manufacturing Lock Washers. William Henry Tice, Portland, Oregon, asigned to Tice Lock Washer Manufacturing Co. Patent 1,833,190.

Tool Retainer. George W. Smith, Ottumwa, Iowa, assigned to Hardsocg Wonder Drill Co. Patent 1,833,236.

TRADE PUBLICATIONS

A.S.T.M. Standards. The American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa., has issued its 1931 edition of A.S.T.M. Tentative Standards, comprising 1,008 pages and containing 180 tentative standards. The volume also contains tentative revisions of 50 existing standards. Paper bound copies are available at $7.00, and cloth copies at $8.00.

Drilling Machines, Radial. The Western Machine Tool Works, Holland, Mich., has issued circular No. 75 on its high-speed radial drilling and tapping machine. The catalog gives illustrations of various important assemblies and lists the features and specifications.

Electrical Equipment. The General Electric Co., Schenectady, N. Y., has issued two publications as follows: Bulletin GEA-1516 on Type AB-1 inclosed air circuit breakers for 250 volts d.c. or 480 volts a.c.—15 to 200 amp., and Bulletin GEA-1522 on the type CR1062 motor-starting switch of the manual, across-the-line type—for small induction motors.

Form Turning Lathes. The Monarch Machine Tool Co., Sidney, Ohio, has issued a 28-page catalog on the Monarch-Keller form turning lathe, which is the Monarch helical geared Timkenized lathe equipped with the Keller automatic electric controls to form a complete unit. The machine is designed for machining any irregular contour.

Honing Machines. The Barnes Drill Co., 814-830 Chestnut St., Rockford, Ill., has issued a bulletin on its No. 214 multiple cylinder honing machine recently described in these pages. This Bulletin No. 117 gives a complete description and shows the various fixtures and heads, together with the specifications.

Recorder Controller. The Bristol Co., Waterbury, Conn., has issued Catalog No. 4001 on its air-operated recorder controller of the free vane type. The catalog gives views of the wall or flush type, a list of features, principle of operation, chart ranges, and suggested piping layouts for complete control of the installation.

Welding Equipment. The Bastian-Blessing Co., 240 East Ontario St., Chicago, Ill., has issued Catalog No. 57, which is a pocket size booklet of 40 pages, indexed for ready reference. It lists specifications and prices of all types of welding and cutting equipment, such as torches, regulators, gas economizers, acetylene generators and the various accessories.

THE PICKLING OF IRON AND ITS ALLOYS

PICKLING consists in treating metals with dilute acid solutions to remove scale or rust. Scales on iron and its various alloys are usually iron oxides classifiable in three groups:

1. Hydrated ferric oxid (Fe_2O_3, H_2O)—ordinary brown rust and soluble in dilute pickling acid.
2. Anhydrous ferric oxide (Fe_2O_3)—similar to brown rust but formed in the absence of water. It is the commonly known "blue scale" and is somewhat soluble in pickling acids.
3. Magnetic oxide (Fe_3O_4)—the black scale formed in hot working operations, and only slightly soluble in acids.

Scales which must be removed by pickling consist chiefly of the two last-mentioned oxides. From their characteristcs it is apparent that they are removed not so much by dissolving the scale itself as by the resultant mechanical action. A thin layer of metal only enters into the solution when the acid penetrates the scale, but the accompanying evolution of hydrogen forces scale off mechanically and it falls to the bottom of the tank.

Pickling acids have little or no effect on oil, grease or lubricating compounds, so that these must be removed, before pickling, in a bath of caustic soda or some similar commercial cleaning compound. Proper cleaning of the material before pickling has a markedly beneficial effect on pickling results. At the same time as much as one-half of the acid otherwise required may be saved where proper cleaning for grease, etc., precedes pickling.

Acids

Sulphuric acid is most commonly used for pickling, due chiefly to its low cost. Concentrations of the pickling solutions vary from 2 per cent to 15 per cent acid, the bath being heated in order to insure the maintenance of a fairly rapid rate of pickling. An unfortunate disadvantage of such hot baths is that the fumes are disagreeable, but in modern plants ventilation systems have eliminated much of the trouble.

Muriatic acid is used in strengths of 10 to 50 per cent commercial acid. While the pickling action of this acid is more rapid and lower temperature can be maintained in the baths, the use of muriatic acid is generally prohibited on account of its high cost as compared with sulphuric acid. Other pickling substances include Edis compound (dry cakes soluble in water), Kleanrite (powder soluble in water) and nitrate cake.

Acid Strength and Temperature

Acid strength and temperature should be considered together, for both factors affect the rate of pickling. Pickling may be speeded up by increasing the acid content up to about 20 per cent actual acid. Beyond this point an increase in acid slows down pickling. In actual practice the acid strength is between 2 and 15 per cent.

Changes in temperature have a greater influence on rate of pickling than do variations in acid strength. An increase of 20 deg. F. will double the rate of pickling. The temperature range for most pickling operations is between 140-180 deg. F.

Acid content and temperature is largely dependent upon individual plant conditions and tank capacities. Acid strength of 5 per cent and temperatures between 140 and 180 deg. are advisable in most cases, giving as they do a minimum of fumes and the best working conditions. Stronger solutions and higher temperatures will increase production, but the added tonnage will be attended by greatly increased volume of fumes, together with the danger of over-pickling, pitting and acid-brittleness.

Where pickling machines are powered by steam, this offers a convenient means of heating the solution. Centrifugal oil separators, are used to remove lubricating oil from the exhaust steam before it is used. Further information on tank design, agitation and heating appeared on page 437 of this volume.

Pitting, Acid Brittleness, Sheet Blistering

Acid does not attack steel uniformly owing to the crystalline structure of the metal and the non-metallic inclusions. Hence the pickled surface is usually roughened. This effect increases as the acid action proceeds, so that a prolonged attack results in a badly pitted surface.

Acid brittleness is known to be due to the absorption of hydrogen, always formed when acid acts on iron. Conditions which favor the absorption of hydrogen are high temperature, dilute solutions and extended pickling time. An acid solution of proper strength with temperature of not over 150 deg. F. and the use of the shortest possible pickling time are factors to be observed in avoiding it. It is evident that any factor which prevents or reduces hydrogen formation will have a favorable action. Inhibitors, which will be discussed later, have an important bearing on acid brittleness. Blistering, like acid brittleness, is due to absorbed hydrogen. Slag inclusions in the original billet are spread out into thread-like formations in the rolling mill. Hydrogen enters these inclusions, or sonions, and raises the surface of the metal into blisters.

Action on Steel

Steel, of course, consists of iron and carbon. Acid dissolves the iron but has no action on the carbon. Thus when the metal is removed, a black deposit of carbon remains. A visible black coating indicates that the steel has been pickled too long.

High-carbon steel is attacked much more rapidly than ordinary low-carbon steels. For this reason it has always been considered difficult to pickle. High-carbon steel requires a sharp, quick pickle. The

(Continued on next page)

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THE PICKLING OF IRON AND ITS ALLOYS

quicker the scale is removed the less steel will be dissolved. Alloy steels are attacked very rapidly, due to the presence of a large number of minute electrolytic couples set up between the steel and the alloying elements. This attack results in a roughened or blacked surface unless great care is used.

Inhibitors

Many of the difficulties attending the pickling of iron and steel may be lessened or entirely eliminated by the addition of an "inhibitor" to the bath. Inhibitors for the most part are colloid chemicals of organic origin which have a peculiar influence on the pickling action. It has been claimed for some inhibitors that they reverse the process of pickling, causing the acid to dissolve the scale and have no action whatever on the metal. These claims are not strictly true. There must be some solution of metal and formation of hydrogen for the scale to be removed with any speed.

The real function of the inhibitor is more complex. When an inhibiting compound is present in the pickling solution, it is deposited on the surface of the metal parts being pickled, most heavily where the tendency toward solution is strongest. Thus the deposit is heavy on the clean metal surface, around slag inclusions and other irregularities and much less heavy on parts still coated with scale. As these colloidal deposits retard solution, action is slowed down where it is not needed and is permitted to take place rapidly where it is needed. In this manner, excessive solution of metal is prevented and the hydrogen generated is very limited.

The advantages that accompany the use of inbibitors are apparent. Sulphuric acid may be used at higher temperatures and in stronger solutions with a great increase in production. This added production, however, is not attended by the difficulties that would otherwise present themselves. There will be a lessening of troublesome fumes, since the hydrogen generation is very small. The amount of metal which goes into solution will be reduced slightly and the possibility of over-pickling and pitting greatly reduced. Acid brittleness and blistering of sheets can be controlled.

Black deposits will be eliminated and high-carbon and alloy steels can be properly pickled without the difficulties which usually are a part of the process. In all cases the use of an inhibitor results in a large saving in acid. Such organic substances as "rye flour" "red dog" etc. are used as inhibitors. Others are marketed under such trade names as "Pickelette," "Picklerite," "Sumfoam," "Rodine," etc.

Formation of Iron Salts

The activity of a sulphuric acid pickling bath gradually slows down, due to the presence of dissolved iron. This effect is not particularly noticeable until the concentration reaches about 8 per cent iron. This per cent is equivalent to 40 per cent iron sulphate or copperas. Pickling, though slowed down, can be carried on until iron sulphate starts to crystallize out and attach itself to the bottom and sides of the tank and to the work. It has been found that crystallization starts at ordinary pickling temperatures, when the dissolved iron content reaches about 10 per cent.

It is usual practice to dump the tank before crystallization starts. It is obvious that some acid is poured out with the discharged liquor. This wastage can be reduced to a minimum by the following practice. When the iron content reaches a predetermined figure, say 8 per cent, add no more acid to the tank but increase the temperature and finally dump when the solution is no longer sufficiently active at the highest working temperature.

The following table shows how much acid is wasted when the discharged liquor contains given amounts of free acid and dissolved iron. The acid wasted is the percentage of the total acid used, including that put in when the tank is freshly charged and the various additions made from time to time, to build up the acid strength.

Per Cent Acid Wasted in Discharged Liquor

Per Cent Acid in Discharged Liquor	—Per Cent Iron in Discharged Liquor—									
	1	2	3	4	5	6	7	8	9	10
1	36	22	16	12	10	9	8	7	6	5
2	53	36	28	22	19	16	14	12	11	10
3	63	46	36	30	26	22	20	18	16	15
4	70	53	43	36	31	28	25	22	20	19
5	74	59	49	42	36	32	28	26	24	22
6	77	63	53	46	41	36	33	30	28	20
7	..	67	57	50	44	40	36	33	31	29

For example, suppose that 500 lb. of acid were used to make up a fresh tank solution and that all of the additions amounted to another 500 lb. The total acid used then was 1,000 lb. If the solution at the time of dumping contained 2 per cent acid and 7 per cent iron, then 14 per cent of all the acid used, or 140 lb. would go down the drain. By using the solution until it contains 1 per cent acid and 9 per cent iron, this loss is reduced to 6 per cent or 60 lb., thus saving 80 lb. of acid.

Rinsing baths should vary in temperature with the material being cleaned. Wire and thin sheets are usually rinsed in cold water, heavy-gage sheets in hot water, the latter drying from heat absorbed from the rinsing bath.

(Abstracted from a booklet of the Weaver Bros. Co., Clinton, Mich., reprinted in "Inco", Vol. VIII, No. 1, supplemented with information in a Mesta Machine Co. bulletin)

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AMERICAN MACHINIST

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New York, December 10, 1931

VOL. 75 NO. 24

Out by Easter

America has come through two tough years. The Administration has done its utmost to check and cushion the downrush of deflation. But it is now all too plain that all business must be satisfied to resume activity on a lower price level. Like a man convalescing from a bad case of flu, business is groggy for the time being, but it is far from licked if business men won't let it be licked.

Far be it from us to discount certain discouraging world conditions. But when were they ever perfect? And when was our export trade ever more than ten per cent of our total? Still farther be it from us to propose an all-inclusive plan for world trade revival—we want only to list four unvarnished and self evident facts for consideration and action in our machinery and metal working industries.

(1) Inventory time is here. Now is the time to reduce all inventories to today's actual market values. You'll have to do it sooner or later. Better do it voluntarily than let the receiver do it for your hungry creditors.

(2) The annual sales meeting is just around the corner. Granted that your line is up to the minute, take your low priced materials and parts, take your deflated labor prices, and make your salesmen a Christmas present of new prices at which they can do business right off the bat in 1932.

(3) Auditing time will be here in January. Deflate your capital assets all you can stand. Check with your auditors, and see that your methods are on a par with those of your most dangerous competitor. Bring your methods up above par.

(4) The Ides of March mean Income Tax Time. Take your losses and your licking right then. Make your deductions when they will do you the most good.

"Beautiful sentiments," say you, "but what will they get me?"

Just this. You will be aligning yourself with the policies of dozens of companies in the field who are operating at a profit right now. Indirectly you will genuinely assist the retail and consumer trade to hit its normal Easter peak. That will mean still more business for you. Whatever your competitors may do, you and your plant and your employees will be

OUT OF THE DEPRESSION BY EASTER

The Price Per Pound Fallacy

It is surprising how many otherwise keen busines men consider bulk as one of the first requisites in getting their money's worth. Whether it be books, automobiles or machine equipment weight and size play all too big a part in making a selection. Calculating the price per pound is the favorite indoor sport not only of purchasing agents but of many otherwise hard-headed business men.

A recent example that comes to light is a special machine developed for a certain industry that is managed by more or less hard-boiled production men. In order to get from these hard-headed but weight-obsessed buyers the price necessary to give a fair return on the cost of building this machine, plus the development expenses, it was necessary to add a few hundred pounds of cast-iron that were not at all necessary for its successful operation. Yet these same men would reject an old fashioned watch of the "turnip" variety, knowing that the new smaller and lighter models give better service.

Merited Honors

It falls to the lot of few engineers to be honored as was Calvin W. Rice, secretary of the American Society of Mechanical Engineers, at the recent annual meeting of that organization. And with reason, because few engineers have done as much for the advancement of the profession as he has through his twenty-five years of effort with the Society. Mr. Rice has been largely responsible for bringing A.S.M.E. to its outstanding position in the technical and civic field.

The honorary membership in the society, which was conferred upon him at the principal social function of the meeting, is one of the highest honors that can come to engineers. Mr. Rice is eminently deserving of the honor, but it must come to him as one that, high as it is, is still overshadowed by the many tributes to his work that have come on this occasion from leaders in this country and abroad.

◂◂ CHIPS ▸▸

We have been dreading it these many moons, but now that the Congress actually is in session, it really seems like old times . . . Business men everywhere keep fingers tightly crossed while they fathom the full import of President Hoover's message . . . and watch the sideshow of preliminary legislative caucusing and bickering and horse-trading . . . To the best of our prognostication and belief, nothing really radical will come of it all . . . even though 3,000 bills are already in the hands of the Government Printing Office . . . 2,000 more scheduled to come . . . Reserve Banks will probably resist any widening of our credit system . . . capitulation is inevitable . . . Most of us are anxious to see what a Republican President will do with a Democratic House majority . . . The English would say, "It isn't cricket" . . . and maybe it isn't . . . At least there is probability of a record vote on prohibition . . . And don't forget that the American Federation of Labor is advocating a general 35-hour week for industry.

Now comes the season for business prophecies . . . Alfred P. Sloan, Jr., leads off with one of a billion dollars for General Motors in 1932 . . . certainly aims high, but bases his figure on concrete plans to lure hoarded dollars out of hiding . . . New elevator code in New York City is bound to make immediate business . . . permits speeds several hundred feet per minute in excess of present 700 ft. restriction . . . orders for new equipment are already being signed . . . Eight major railroads announce reduced fares for Christmas holidays . . . U. S. Shipping Board grants final approval to merger of the Dollar, Dawson, I.M.M.-Roosevelt and U. S. Lines . . . over 100,000,000 dollars involved . . . Two new "sea trains" ordered for Gulf-ports-to-Cuba car ferry service . . . each to provide employment for 2,000 to 3,000 men and to cost 1,500,000 dollars . . . New York automobile Salon winds up with sales topping 1,000,000 dollars . . . With retaliatory tariffs prohibitory in Europe, motor car manufacturers plan further to invade South America, Africa, Australia and the Far East . . . Heads of National Warm Air Heating Association report industry operating at 70 per cent capacity . . . expect 50 per cent increase for 1932 . . . McGraw-Hill welcomes the New York offices of Lincoln Electric Company to the new building . . . Bell System's teletypewriter service receives amazing reception . . . several thousand installations ordered in one week . . . 1,500 service and installation men rehired immediately . . . Teletypewriter Corporation receives enormous order for the necessary mechanisms.

British realtors (if that's what they call themselves) evidently believe that the new tariff will force the establishment by foreign manufacturers of branch factories in the British Isles. A recent copy of the *Daily Mail*, sent to us by a correspondent, carried advertisements of 14 agents for factory properties. The trend is worth watching.

Sterling dominates the European and world situation . . . Where is it headed and how far? . . . One distinguished economist believes it will stabilize itself around $3.20 . . . Meanwhile France worries more than any power . . . and rushes through a 120,000,000 dollar unemployment relief appropriation . . . She seems to be entering a private tariff war with Great Britain with all the dignity and insight of a filling station proprietor . . . Germany opens offensive towards reparations reduction . . . and, she almost hopes, abolition . . . U.S.S.R. plans to spend 145,000,000 dollars to make Leningrad the "model Soviet city" . . . Neutral foreign military observers report that Chinese are planning no offensive as previously reported by the Japanese . . . Cold weather and frosted fingers combine to cool ardor of both combatants.

D.L.&W. orders ten heavy, high-speed Poconotype freight locomotives from American Locomotive Company for 90-day delivery . . . will also build six drill-type in its Scranton shops . . . U.P. recalls 3,000 men to its Los Angeles shops . . . M.K&T. rehires 1,000 men in various shops . . . 50,000 more automobiles sold in October than were manufactured . . . Pierce-Arrow recalls 800 employees to its Buffalo plant . . . now has payroll of 3,000 . . . Oakland to add 1,700 men . . . Chevrolet employment now 15 per cent higher than a year ago . . . Chevrolet, Diamond-T, General Motors, Pierce-Arrow, Reo, Studebaker and Willys all sold more automobile trucks during October, 1931, than during the same months last year . . . Torrington Company works 40 hours per week on needles for the busy garment industry.

THIS WEEK IN *AM*

Bitter medicine is advocated on page 906a, but when you read "Out by Easter" the second time, we believe that you will agree with it in principle and that you will use your own influence to line up your own company. With a definite program and a definite date at which to aim, hundreds of manufacturers can end their strictly private depressions if they will. Write us your views while the subject is fresh and warm in your mind.

Again one of the finalist briefs for the *AM* Awards becomes a leading article. "Planned Replacement in a 14-Year Old Plant" (page 872) describes the replacement policy of Pittsburgh Gear and Machine Company. Though the equipment was to a large degree newly bought when the company was organized, the management thought of replacement from the beginning and laid aside a segregated replacement reserve. J. H. Jackson, sales manager, has done a beautiful job in briefing the results.

John Younger, professor of Industrial Engineering, The Ohio State University, contributes a piece of fundamental manufacturing philosophy in "Finding the 'Average Man'" (page 879). Mr. Younger is one university professor who keeps the "shop touch" and knows how to express his views in a minimum number of words.

"Dominant or Dumb?" (page 880) raises a personal executive question. We would like to have your views for publication. Herbert Chase furnishes us with another of his thorough articles in "Automatic Spring Testing" (page 887). Walter Wells is again represented with "Laying Out a Drill Jig" (page 890). "The Pickling of Iron and Its Alloys" (page 905) gives the latest and most approved practice in the handy form of a double Reference Book Sheet. "When to Replace Equipment" (page 892) is abstracted from an outstanding A.S.M.E. paper by distinguished authors.

"Advances in Printing Press Manufacture" (page 883) is the first of three exclusive articles describing how R. Hoe & Co. now build gigantic presses on a production basis. How many readers are aware that Hoe is a pioneer in inserted-tooth saw manufacture as well as a leader in printing presses? Perhaps we should send the staff editor back for still another story.

• COMING •

Six down and two to go. Next week you will have the privilege of reading what one of the pioneers in equipment replacement planning has done in actual practice. Millions of dollars worth of machine tools are used in the plants of Westinghouse Electric & Mfg. Co. The story of how they are purchased, maintained and replaced constitutes an invaluable addition to the literature of management. You will feel even more indebted to the Committee on Awards for insisting on the publication of all eight finalist briefs for the *AM* Awards.

Although the routine of taking inventory in most plants has been established for many years, a new slant on the subject may assist you with your own. Look forward to reading an able article on what determines the obsolescence of machine parts. And we will swear that you will find some valuable ideas on the second article in the R. Hoe & Co. printing press series. This one will describe advanced methods in erection.

As a complement (and possibly an antidote) to an article in this week's issue, we have spent considerable time and money in securing the material for an article which will show actual instances of where jig borers are making jigs unnecessary. Sounds almost like a paradox, but it isn't. The Reference Book Sheet will give two closely-set pages of blank diameters for cylindrical shells of various diameters and heights.

The issue of December 24, is coming pretty close to Christmas, but plum pudding or no plum pudding, you will be glad to read the Rotor Air Tool brief.

THE . INDUSTRY .

Progress in Metal-Working and Machinery Markets

SOME inquiries and some orders relieve the usual year-end dullness of the country's tool markets . . . No general trend of the market or no general type of sales can be registered, nor is any change of consequence anticipated until after the New Year . . . Sales vary from small tools to specialized units and go to a wide variety of users, almost always for replacement . . . Used tools, to sell, must be exceptionly good and available at sacrifice prices . . . Some means of breaking down sales resistance is the paramount need.

NEW YORK expected a slow month, consequently its few orders and bettered inquiries look good . . . Detroit has a few automotive replacement orders and expects more immediately, with indications good for good-sized sales early in the new year . . . Chicago has inquiries in fairly good volume, of a sort that indicate replacement shortly after the holidays . . . Studebaker has bought more tools, Nash and Northern Pacific are inquiring, and other automobile builders in the district look like good prospects . . . Cincinnati, seeing red ink, feels blue, though scattered small inquiries are increasing.

NEW ENGLAND sold a few more expensive tools, some lathes, small tools, and scattered repair parts . . . Soviet prospects still hinge on a mutually satisfactory solution of the credit problem . . . Indianapolis expects the present small volume of sales to continue throughout the winter, with the radio trade, farm implement makers, and airdromes the leading buyers . . . Canada reports a marked improvement in inquiries and sales, with general manufacturing coming up, thus forcing purchases of equipment . . . San Francisco has had a slight improvement in sales of metal-working tools, although the big market remains in food and miscellaneous machinery.

NEW YORK

One large dealer reports a small order a day; another has noticed an upturn in inquiries. With these exceptions, the market is unchanged. December was, however, expected to be a slow month, and even a betterment in inquiries exceeds expectations. Inquiries of a more active sort are appearing, and some dealers are busier on quotations than they have been for some time; but the difficulty remains that of converting these quotations into something more substantial.

DETROIT

A few more replacement orders are being placed by automobile manufacturers, and indications point to additional business within the next few weeks. So far the production plans of the automobile manufacturers do not include the purchase of any large amounts of new equipment. There are some signs that the actual replacement of worn out machinery will amount to more than the dealers estimated a few weeks ago. Inquiries are increasing and several good sized deals have been closed.

CHICAGO

Machine tool inquiries are being received in fairly good volume; they are of a character that would indicate equipment replacement needs will be taken care of in larger number after the holiday season. This applies more particularly to automobile plants now working on new models. Additional orders to those heretofore noted are reported from the Studebaker Corp. Inquiry from the Nash Motor Co., promises well for the near future. Among recent inquiries is one from the Northern Pacific for a 4-ft. motor-driven radial drill. Prospective business in machinery and shop equipment is expected to show gradual improvment with the advent of 1932.

CINCINNATI

A dole of business continues to drift in to manufacturers and to selling agents, and the best that can be said is that the demand is "as was." A fair volume of scattered small inquiries are coming in, but replies are not bringing much in the way of sales. That there will be much red ink on annual statements is a foregone conclusion, and while there is considerable hope as to next year there is not much optimism.

NEW ENGLAND

A few sales for the more expensive machine tools added a bit of luster and excitement to an otherwise overcast and quiet situation. Lathe prospects, a scattered distribution of small tools, repair parts and small machine units constituted most of the action of the week. Foreign negotiations remain at a debatable stage. Some manufacturers are insistent that future contracts be negotiated at previous terms, while the Soviet interests desire a more liberal credit.

INDIANAPOLIS

Little encouragement is seen from the amount of machinery or machine tool purchases. Continued small volume is looked for until late in the winter, with some exceptions for seasonal industries. Radio cabinet factories are buying single tools, and the farm implement concerns are also a little more active. It is believed the radio trade will be a more or less consistent buyer during the winter, and some inquiry is coming from furniture manufacturers. No business is coming from either the iron and steel trade or the railroads. Some small tools are being sold to the machine shops of airdromes. Heavier air traffic across the middle and north of the state is making additional facilities imperative. There will be no new fields installed until next year, however.

CANADA

Machinery and machine tool manufacturers report marked improvement in inquiries and sales. Manufacturing generally is giving evidence of betterment, many instances being reported of enlarged staffs and contemplated new enterprises. Better prices for farm products are lending encouragement to implement makers, and there is also a broadening in demand for steel. The iron market remains sluggish, but there is a better feeling evident as a result of the resumption of operations in one of the larger locomotive and car-building shops. Newsprint mills are operating at greater capacity. Radio volume is being maintained at a satisfactory level, and there has been an improvement in the demand for general hardware. Bronze plants show increased activity, and demand for electrical appliances is steadily improving.

SAN FRANCISCO

With but another month in 1931, machinery houses are busy taking inventory, and not many orders are being booked. However, there is a definite pickup in inquiries. An executive of one of the large machine tool houses declares business is not worse, that in fact there is a slight improvement. Machinery used in the manufacture of food commodities takes the lead in sales. Bids on twenty-six southern California highway projects will be advertised before April 1, 1932, and it is believed a large sum will be expended in this portion of the state also.

An analysis of several consolidated carloads from the East, always a fair index to machinery conditions, shows some large machine tools and metal-working machinery, some transmission machinery, drills, and similar equipment, with the bulk of the shipments consisting of repair parts and small shop supplies.

WEEK . BY . WEEK

BUSINESS BAROMETER

Trends in General Business throughout the world

THEODORE H. PRICE
Editor, Commerce and Finance, New York

An old toast to the United States describes it as "bounded on the east by primeval chaos, and on the west by the day of judgment." This description is suggested by last week's developments in the Far East. The facts are hard to obtain, but the strangulation of China by Japan seemed indicated by some of the dispatches, and the tangle in the diplomatic situation has not been entirely ironed out by the various explanations offered.

Meantime, the European problem is like some great rivers which are aseptic-ized by exposure to the air as they flow. The more important nations are beginning to realize that in the old world, as in the new, it is a case of "united we stand, divided we fall," and a prominent and influential London newspaper has committed itself to the advocacy of a free trade policy to be adopted by the British Empire and all the other important European powers. Such a solution of an otherwise unsolvable problem would be welcomed even in the United States, which is the largest tariff protected area in the world.

The price of sterling is, of course, the most important factor in the week's development. In New York the pound has sold at $3.25, which is the lowest figure touched since Great Britain announced Sept. 21 that she would suspend gold payments. All sorts of rumors are current with regard to the stabilization of the British currency at or around present prices, but no official announcement has been made, and the public is as much in the dark as ever. Inasmuch as the credits predicated on a sterling basis run into a stupendous total it is, of course, highly important that the value of the British currency be stabilized as soon as possible. But it should be remembered that England will enjoy an enormous advantage in the markets of the world as long as she is able to sell finished goods for currencies of greater value than sterling. For this reason, she may not be in such a great hurry to stabilize the money in which her debts are payable.

It is indeed a case of almost "primeval chaos," and even a cursory consideration of the facts impresses one with the need of cooperative, or at least coordinate, action by all the powers that aspire to be factors in the world of trade or finance.

It is, in fact, this aspect of the situation that makes one most hopeful. Cooperation, even though it be unwelcome, is generally agreed to whom it becomes indispensable, and the world of today is so desperately in need of economic cooperation that it seems inevitable that some workable plan should soon be devised and adopted.

Investment Buying

Upon this theory and the conclusions drawn from it there was not a little investment buying of stocks and commodities in the American markets last week. The purchasers belonged to the class generally known as bargain hunters, who are sometimes laughed at because they are furtive in their operations. They are, however, an important factor in all great markets, and their investments made last week must total a large amount. It is true that these purchases had but little effect in advancing values, but the aggregate of the investments made is enormous, and sooner or later it must have its effect.

The commodity markets were held in check by the economic situation in Europe and the hesitancy of the New York stock market. The net change was not great, and the speculative interest in the more important staples seems to be on the increase.

Distributive trade in the United States seems to be improving. While railroad earnings have not yet had a chance to recover themselves, the indications for the new year would seem to be encouraging. Of course, the atmosphere is blue; everybody talks in a despondent strain; and in New York it has become almost the fashion to boast of the losses that a great many amateur traders have recently been forced to accept.

But this mood will not last long. Hope and confidence are normal, and they must soon reassert themselves. When this change in the public attitude takes place we shall see better times. If the price level of either securities or commodities were to remain as it is at present for any great length of time America would be bankrupt, and the rest of the world would be mendicant. Such a condition is hard to describe in words, and it is inconceivable. Therefore, the ranks of the optimists are being rapidly increased by the enlistment of practical, hard-headed men who realize that prices cannot decline indefinitely or permanently.

That such men are showing their faith in the future by action is indicated by the gain in circulation and advertising announced by the *New York Times* in a statement published last week. The advertising sections of the newspapers constitute, probably, a more dependable business barometer than the stock market. When pages of display advertising show a multiplying tendency for any length of time, there is no longer any doubt that business is on the up-grade. Things have worked out in just about this way in every depression the United States has had.

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THE BUSINESS WEEK

December 9, 1931

It involves no serious strain on one's optimism to see in the current statistical straws some signs of stabilization in the level of domestic business activity and some promise of improvement in the next ninety days. . . . The October bulge in commodity and stock prices as well as in some business indicators was in larger part wiped out during November, but on the whole there has been no serious set-back, and some net gain. . . . Stock averages have been bashful about breaking through the bear market lows; commodities still oscillate reassuringly around the levels that have been held for nearly six months. . . . Steel activity and carloadings have succumbed very slowly to the usual seasonal slackening, and some stimulus to steel is still to be expected from year-end and new-model automotive demand. . . . The heart breaking bond market is the outstanding and disturbing exception to this promising picture; and the accompanying banking strain and slackness in new capital issues must be overcome before we can count on a clear track for recovery. . . . The imminent bankruptcy of Germany and the threatened breakdown of our own railroad structure unless prompt relief is supplied are now the most or only formidable obstacles to stabilization of the securities markets and fundamental betterment in the outlook for business in this country. . . . It is reasonable to expect that something constructive will soon be forthcoming toward the recuperation of railroad credit, and while one cannot be so hopeful about European affairs, American business opinion is rapidly reconciling itself to the fact and turning its attention to domestic possibilities.

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Material Trends and Prices . . . .

The new minimum on steel shapes, of $1.50, base, Pittsburgh, for shipment in 1932, represents a decline of 10c. per 100 lb. in the face of a rise of 2c. per 100 lb. in freight costs. Moreover, at this time last year, the base rose 5c. per 100 lb., to $1.65, Pittsburgh, for delivery early in 1931. Strip steel and auto-parts materials are in active demand at this time. Also, there is substantial buying of lead in the Middle West, with prices firm. Nevertheless, a decidedly downward trend prevails in both demand and prices of most of the non-ferrous metals. An additional 10 per cent now is available in discounts on bolts and nuts. Scrap non-ferous metals declined this week at New York but held firmly in Western cities.

(All prices as of Dec. 4, 1931)

IRON AND STEEL

Pig Iron —	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$11.00	$11@$12	$14.00
Buffalo, No. 2, Fdry., per gross ton	15.00	17.00	15.25
Heavy Melting Steel Scrap — Pittsburgh consuming point, No. 1, per gross ton	10.00	10.00	12.75
Furnace Coke — Connellsville, per net ton	2.35	2.40	2.40
Foundry Coke — Connellsville, per net ton	3.25	3.25	3.50
Steel Shapes — Pittsburgh, base, per 100 lb.	1.50@1.60	1.60	1.60@1.65

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Iron Machinery Castings — Cost in cents per lb. of 100 fly-wheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb.:

Chicago	4.62½	Cleveland	4.50	New York	4.75
Cincinnati	4.35	Detroit	4.00		

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Steel Sheets — Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Blue annealed, No. 10	1.85	3.20	3.00	3.40
Black sheets, No. 24	2.40	3.55	3.60	3.50
Galvanized, No. 24	2.90	4.10	4.00	4.00

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Seamless Steel Tubing — Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall		Outside Dia. in Inches						
		⅜	½	¾	⅞	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

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Shapes, Plates, Bars, Etc. — Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.90	3.60	3.60
Cold fin., round or hexagon	3.40	3.10	3.10
Cold rolled strips	4.95	6.00	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.65	3.50
Rivets	4.00	4.00	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

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Stainless Steel — Hot-rolled bars, base, Pittsburgh. 0.12 per cent carbon, cents per lb.:

Chromium		Chromium	
15% and under	19.00	18 to 23%	23.00
15 to 18%	20.50	23 to 30%	28.00

Bolts and Nuts—Discount from list, f.o.b. mills, Birmingham, Chicago, Cleveland and Pittsburgh, on bolts (except tire and stove), nuts, and lag screws, mill lots..... 73–10–10%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:	
Aluminum ingots 99%, N. Y	23.30
Copper, electrolytic, Conn	6.25
Copper wire, base, Chicago and Cleveland	8.87½
Copper wire, base, N. Y	8.75
Lead, pigs, E. St. Louis	3.65
Tin, Straits, pigs, spot, N. Y	22.37½
Zinc, slabs, E. St. Louis	3.12½
Prices following are in cents per lb., base, N Y., Chi. and Cleve.:	
Brass rods, high	10.62½
Brass sheets, high	12.87½
Brass tubing, high	16.12½
Copper, drawn round	13.37½
Copper sheets	15.87½
Copper tubing	15.37½
Prices following are in cents per lb., del. from N. Y. warehouse:	
Babbitt, anti-friction, general service	28.50
Babbitt, com'l, intermediate grade	34.25
Babbitt, genuine, highest grade	43.00
Solder, bar	17.37½
Prices following are in cents per lb., base, Huntington, W. Va.:	
Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals — Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.25	2.25	2.25
Light brass	1.75	1.75	1.75
No. 1 rod-brass turnings	2.75	2.50	2.25
Heavy copper	4.75	4.00	3.75
Light copper	3.75	3.50	3.25

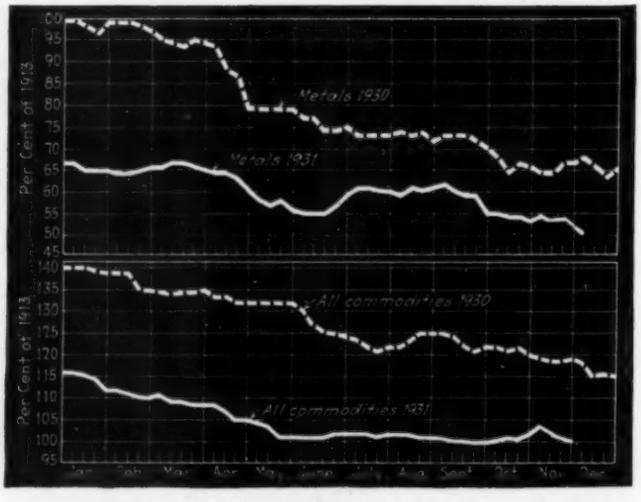
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy	30–10%	40%	40%
Belting, rubber, trans., Grade 1	60–10–10%	60–10%	60%

Lumber — Per M ft., b.m., 12-16 ft. lengths, delivered, N. Y.:

Crating — Southern pine:
1x4-in. ..... $27.00 1x6-in. $26.00

Skids—Spruce:
2x4-in. ..$37.00 3x4-in. ..$40.00 4x6-in. ..$42.00 6x6-in. ..$50.00



Price Movements Week by Week

Average Price of Raw Metals: Pig Iron, Billet Steel, Copper, Tin, Lead, Zinc—American Machinist
Seventy-Four Commodities Index—The Annalist

NEWS

A.S.M.E. Annual Meeting Features Active Discussions

Some 2,500 engineers registered for the annual meeting of the A.S.M.E., held in New York City last week, at which the election of CONRAD N. LAUER as president was announced. Mr. Lauer will succeed ROY V. WRIGHT. His nomination, as well as that of the other officers, was announced last summer in *American Machinist*. Only one ticket is nominated, hence no changes occur.

The society's gold medal was awarded to ALBERT KINGSBURY, president of the Kingsbury Machine Works of Philadelphia, for research and development work in lubrication. Mr. Kingsbury also won one of the three John Scott medals "for the invention of a thrust bearing for use in ships and heavy machinery." Other John Scott medal winners were ALBERT H. EMERY, JR., "for the invention of the Southark-Emery testing machine, a mechanical device for testing materials," and WILLIS H. CARRIER of the Carrier Corporation "for the invention of process and apparatus for cleaning, purifying, and humidifying the air." These medals are the gift of the City of Philadelphia. The Melville Medal was awarded to ARTHUR E. GRUNERT of Chicago. Honorary memberships were awarded to DR. PALMER C. RICKETTS and CALVIN W. RICE, as previously announced.

Gear Research Conference

A meeting was called by RALPH E. FLANDERS, Chairman of the A.S.M.E. Special Research Committee, to point out the present status of this committee and to crystallize plans for future work.

With the publication of PROF. EARLE BUCKINGHAM'S report on "Dynamic Leads in Gear Teeth" one step in the committee's work was concluded. The machinery for further research is available. Prof. Buckingham has expressed a willingness to extend his experiments. The testing machine and other laboratory facilities at M.I.T. may be employed for a wide variety of such work. The immediate problem is to decide just what direction this work should follow.

Among the suggested possibilities for further study are: (1) measurement of the intensity of the dynamic loads on the different gears of a train, on helical gears, on beveled gears, and on worm gears; (2) investigation of compressive fatigue limits on various gear materials; (3) investigation of design factors on performance of non-metallic materials; and (4) friction losses in gears. Additional topics brought up for study were noise in gear trains and the lubrication of gears.

No final decision was reached at this conference as it was agreed that further thought and wider comment is needed before reaching so important a conclusion. The committee wishes to emphasize that it is important to those firms interested in gears to submit their ideas on future research. Only in this way can a program be selected that will be of maximum value to industry.

Stabilization Symposium

Three papers were presented at this session, one of the most interesting of the meeting: Some Thoughts on the Solution of the Depression Problem, by PAUL MAZUR, partner, Lehman Bros., New York; The Unemployed—What Shall We Do With Them? by J. W. HOOK, president, Geometric Tool Co., New Haven; and The Economic Aspects of Stabilization, by VIRGIL JORDAN, economist, McGraw-Hill Publishing Co., Inc., New York.

Speaking from the banker's position, Mr. Mazur stated his belief that because the Federal Reserve System can control at most only one-quarter of our national financial resources it is definitely obsolete and must be replaced by something more suitable. Control of price levels, Mr. Mazur holds, is essential to stability. Our banks have done little to accomplish this object, but banking could do much if properly set up.

Mr. Mazur believes that neither prohibition repeal nor a reduction of the tariff would help much to stimulate business, but that settlement of the international debt problem would be helpful. He is convinced that we should have some national group or commission to stimulate and coordinate economic research.

In this address, Mr. Hook divided the unemployed into three groups: the unemployable; the casual, seasonal, nomadic workers; and the steady employees—25 per cent fall in the first group, 35 in the second, 40 in the third. Mr. Hook believes that private and organized charity must take care of the first group at all times; that made work secured through careful advance planning by municipalities, counties, states and the federal government must provide for the second group; and that the employers must make provision for the steady workers, for their own selfish interest if for no other reason. Plans to this end should be made on the assumption that there will be a major depression at least every seven years.

Dr. Jordan quoted Prof. Gregory to the effect that our problem today is to find the will to carry out the reforms indicated by our knowledge of what is at fault in our economic structure. To the economist, the problem of promoting recovery from this depression is less difficult than that of fostering the future stability of business. Business stabilization in the United States is only possible on the basis either of comprehensive and continuous international cooperation, or of completely controlled isolation. The latter is the only one likely to be realized.

He anticipates at least one more inflationary boom in which we will give away a lot more goods to the world on credit and maintain a high tariff to prevent repayment. One of the most vital factors in the current depression is the psychological factor of insecurity which leads to hoarding, to restriction of purchasing, etc. Its importance cannot be overestimated.

Comments on the paper, "Elements of Milling," by Prof. O. W. BOSTON of the University of Michigan and CHARLES E. KRAUS, senior student, were directed against the difference between the test apparatus employed and actual milling practice. It was pointed out that uniform speed of the cutter, progression of the work during the cut, simultaneous cutting of two or more teeth, and other conditions found in milling operations were absent in the pendulum dynamometer. Another criticism was voiced against the exclusive use of slot-milling which entails side drag on the cutter.

Other discussers defended the methods of the authors on the ground that any scientific study must reduce the problems to its elements and keep all conditions constant except those under observation. Mr. Kraus, in summing up the discussion, stated that the present paper represented only a start and that further experiments were contemplated.

"Dividend Program Related to Depreciation" aroused a spirited discussion. Some of the comments were to the effect that while the proposals set forth in the paper were desirable, they did not go far enough. For instance Mr. Fields' reference to the need of depreciation reserves should according to some speakers be extended to depreciation funds, that is, actual cash should be set aside instead of confining the transaction to a bookkeeping entry.

Others voiced the opinion that the paper followed accounting practice instead of the actual conditions found in industry. The setting up of reserves based only on the original cost was de-

cleared to be inadequate because replacements were often required not in kind but in more modern and efficient machinery. The author's basis of original cost and rather than replacement value was also a subject of criticism. The general feeling seemed to be that while the half a loaf, as outlined by Mr. Field, was better than none it was preferable to call attention to the need of the whole loaf.

The presentation of a paper "Economic Life of Equipment" followed. Most speakers admitted at the outset that they had not fully digested the mathematics preferred by the authors, H. O. VORLANDER and F. E. RAYMOND, and more felt that perhaps the theoretical analysis had been carried too far. These latter expressed the need for a formula that even a sales manager or a manufacturing executive could understand. ERNEST F. DUBRUL stated that the formulas could be simplified by limiting them to more specific applications. Other speakers were HAROLD V. COES, W. H. RASTALL, and GEORGE HAGEMANN.

Whether the three independent papers on photoelasticity were accidental, or arranged by the program committee, the three contained about all that can be said, and brought the art up to kinematography and color photography. The only thing needed is to combine the two and add the sound of the material groaning under the stress. Dr. Froht's paper and especially the moving pictures gave a visualization of stresses that could be gained in no other way. It is hard to imagine a static photoelastic series that could show the initial strain, gradually growing until it meets its maximum. The next step is naturally ultra rapid photography of destructive strains, and vibration.

The paper by Prof. Solakian was of more immediate practical value to the shop because it dealt with keyway stresses. In some cases it was shown that chamfering the corner of the keys was beneficial in other cases it threw additional strain on the center line. Incidently, the stress curves showed why a key tends to roll. Most of the strain on the key is above the division between shaft and pulley on one side and below the division on the other side. In other words the force applied by the pulley tends to tip the key. In the discussion of this paper an engineer from the Westinghouse Electric Company described the findings of an investigation into the relation of keyways to small shaft breakage. These experiments showed that where the keyways had been routed out with an end mill, breakage occurred at the beginning of the end radius. To offset this they tried a keyway milled with a flat cutter, leaving the two ends of the keyway to the radius of the cutter. In this case the break occurred where the radius joined the flat bottom.

Other papers have been abstracted previously or are available from the society and will appear in its publications.

Savings in Planning and Coordination Stressed by Taylor Society

Particular emphasis was placed on the efficacy of business and governmental planning at the three-day annual fall sessions of the Taylor Society held in New York City Dec. 2, 3, and 4. With HENRY BRUERE, President of the Bowery Savings Bank, acting as chairman, the subject "Some Reflections on National Planning." HORACE B. DRURY, U. S. Shipping Board, RALPH E. FLANDERS, manager, Jones & Lamson Machine Co., and GROVER A. WHALEN, general manager, John Wanamaker, discussed the topic. All agreed on the necessity for coordinating production to consumption and the desirability of positive measurements to effect such coordination.

Savings totaling over $19,000,000 not including interdepartmental transfers of surplus property since the inauguration of the service of coordination were cited by ADMIRAL T. T. CRAVEN, chief coordinator of the Federal Coordinating Service at Washington, D. C. Still more important than the monetary benefit has been the development of a conception of cooperation and service between the various departments. The red-tape bound walls of departmental prestige have gradually yielded to unselfish coordinated control.

Admiral Craven particularly stressed the need for a similar evolution in industry to prevent deflation of natural resources and to avoid waste through overproduction and unscientific methods of distribution.

"The Responsibility of the Church for the Solution of Industrial Problems" was discussed under the chairmanship of ELLIOT DUNLAP SMITH, professor of industrial engineering of the Sheffield Scientific School, Yale University.

Standardization in American Industry has hardly begun, according to MYRON H. CLARK, vice-president of the Reading Iron Co., in his talk on "Development and Application of Standards to Production Management." Whereas the main objective is company profits, the welfare of employees, service to customers, and benefit to the community must also be borne in mind.

Real wages will rise as the result of the present depression, was the opinion voiced by GEORGE SORILE, economist and editor of the *New Republic*, in discussing "Power and Mechanization as Causes of Depression." This opinion was based on the fact that real wages do not decline as sharply as prices and the prediction that the claim of capital against industry will be largely written of in the next upswing.

PROF. HUDSON BRIDGE HASTINGS, Sheffield Scientific School, Yale University, thought that profits could be maintained as long as profits were reinvested in capital goods rather than consumable products to be thrown immediately on the market. A whittling away of purchasing powers with a lowering of production costs contributed to the depression according to MILTON C. HERRMANN, president of the Herrmann Hankerchief Co. EDWARD F. HARVEY, of Philadelphia, would have the government discount prices 20 per cent to purchasers of goods at retail. This, he believed, would revive trade.

G. CHARTER HARRISON, Chicago, expounded his favorite topic "Standard Costs as an Element of Managerical Technique." He pointed out the value of standards as applied to selling costs, to avoid passing the point of diminishing returns.

Flanders Favors Loans Instead of Tax Rise

Municipal, State and government financing must be based upon the business cycle and must not rely upon annual taxable income to meet the yearly budgets, according to Ralph E. Flanders, chairman of the economic committee of the American Engineering Council, Washington, D. C., who told the Joint Legislative Committee on Unemployment, Dec. 4, that in boom times taxes should be high, but in bad times public budgets should be financed from borrowing.

Mr. Flanders said borrowing and taxation were not evil and that they could be turned to constructive uses if applied at the proper time in a business cycle. To get out of the present depression he advocated borrowing, although he said this policy should have been followed last Fall. He opposed taxation as a way out now because he felt it would accentuate present difficulties.

New York Aids Needy Professional Engineers

The Professional Engineers Committee on Unemployment has raised more than $19,000 in cash and has received pledges for a considerable sum in addition, according to an announcement by H. DE B. PARSONS, chairman of the Committee. Approximately 680 engineers have registered, of which number about 300 are reported to be destitute. Jobs have been found for 149.

The Committee, with headquarters in the Engineering Societies' Building, was recently organized by the four National Engineering Societies. It is estimated that more than $200,000 will be required to carry out the relief program. Donations are being solicited.

S.A.E. Plans Annual Meeting For Detroit Next Month

The next annual meeting of the Society of Automotive Engineers will convene at the Book-Cadillac Hotel, Detroit, on Monday, Jan. 25, and technical sessions will be held throughout the week until Friday, Jan. 29. The Passenger-Car Activity is sponsoring three technical sessions, at which consideration will be given to front-wheel alignment, bearings and chassis matters. Other sessions, sponsored by the various Activities, will be devoted to problems of passenger-car bodies, transportation and maintenance, motor-coaches and motor-trucks, aircraft, Diesel engines and production. There will also be a standards session, a research session and a general session, the last to be sponsored by the National Meetings committee and to be preceded by a dinner at which the Detroit section will act as host to the National Society.

Included in the program for the Passenger-Car sessions are papers on: Front-End Engineering in Relation to the Service-Field Situation, by C. P. GRIMES, of the Grimes Brake Engineering Service; one on the Geometry of the Front End, by W. R. GRISWOLD, of the Packard Motor Car Co.; and an Analysis of the Work and Conclusions of the Front-Wheel-Alignment Research Subcommittee, by J. M. NICKELSEN, professor at the University of Michigan. Bearings and their problems will be discussed at a symposium at which the subject will be considered from three viewpoints, that of the oil man being given by D. P. BARNARD, 4th, of the Standard Oil Co. (Indiana); that of the bearings manufacturer by J. V. O. PALM, of the Cleveland Graphite Bronze Co., and that of the car designer by ALEX TAUB of the Chevrolet Motor Co.

SIR DENNISTOUN BURNEY, internationally known for his activities in connection with both automobiles and aircraft, will talk to the annual meeting on his streamlined automobile. It is understood that Sir Dennistoun will bring two cars with him for demonstration purposes, and that he will emphasize the advantages to be gained from streamlining and from mounting the engine in the rear. N. F. HADLEY, R. K. LEE and R. N. JANEWAY, all of the Chrysler Corp., will discuss a new type of engine mounting, Mr. Hadley interpreting the "floating-power" mounting from the production angle, while the other two men explain the technical side of the design. DR. FRED A. MOSS will report on the riding-qualities research, which he has undertaken, and two papers will be presented on body design, one on Safety Factors, and the other on Noise and Heat Control in the Automobile Body.

JOSEPH GESCHELIN, of *Automotive Industries*, will speak at the Transportation and Maintenance session on standards for determining when to reuse and when to junk a used part. Two papers at the Motor-Coach and Motor-Truck session will discuss the trend of size and type of power-plants and transmissions in motor-coaches and motor-trucks.

JOHN N. WILLYS will be the speaker at the annual dinner of the Society of Automotive Engineers, to be held in the ballroom of the Pennsylvania Hotel, New York City, Jan. 14, 1932, according to a statement just issued by JOHN A. C. WARNER, general manager of the S.A.E. Mr. Willys, who is United States Ambassador to Poland, has long been connected with the automotive industry, having been for some years president of the Willys-Overland Co. and later chairman of the board. Mr. Willys will be introduced by WILLIAM P. MACCRACKEN of Washington, formerly assistant secretary of commerce for aeronautics and now member of the firm of MacCracken & Lee. The only other speaker scheduled for this banquet will be "Senator" Ford, the humorist. The banquet, an annual event, is the chief social function on the calendar of the S.A.E., and it customarily takes place on the Thursday evening of the week of the New York Automobile Show. Arrangements are in charge of a committee consisting of ADOLPH GELPKE, of the Autocar Co.; F. K. GLYNN, of the American Telephone & Telegraph Co., and NORMAN G. SHIDLE, of the Chilton Class Journal Co.

Soy. z Photo, Moscow

Soviet edition of the familiar American campaign thermometer — designed to speed machinery production

Federal Specifications

Proposed revisions of Federal specifications, submitted to industry for criticism, include: QQ-M-151 for the Inspection of Metals to succeed 339a, QQ-T-351 on Phosphor Tin to succeed USGMS116, QQ-2-351 on Slab Zinc (Spelter) to succeed USGMS91a, and a new specification, WW-T-711, on Seamless Aluminum-Manganese Tubing.

Metal-Working Machinery Exports Show October Falling Off

Washington, D. C., Dec. 1—Exports in the machinery group in October were valued at $29,373,306. This shows a decrease from September when the value of machinery exported was $34,914,340. Exports in October of this year show a decline of $12,000,000 as compared with the value of exports in October, 1930. The figures are those of the Bureau of Foreign & Domestic Commerce. The principal subdivisions of the exports, with revised comparative figures for October, 1930, follow:

	October, 1930	October, 1931
Electrical machinery and apparatus	$9,332,470	$7,860,374
Power generating machinery (except electric and automotive)	1,079,990	739,891
Construction and conveying machinery	1,450,985	512,775
Mining, well and pumping machinery	2,236,958	1,319,102
Textile machinery	1,505,750	1,180,016
Sewing machines (domestic)	242,574	80,598
Sewing machines (industrial)	263,309	323,138
Other industrial machinery	5,503,322	2,427,346

The detailed comparative figures for power driven, metal-working machinery follow:

	October, 1930	October, 1931
Engine lathes	37,612	12,763
Turret lathes	115,433	8,868
Other lathes	47,212	54,077
Vertical boring mills and chucking machines	64,512	20,362
Thread cutting and automatic screw machines	46,970	31,569
Knee and column type milling machines	52,152	19,669
Other milling machines	124,233	28,956
Gear cutting machines	18,562	23,687
Vertical drilling machines	17,120	16,470
Radial drilling machines	7,783	11,924
Other drilling machines	23,757	57,819
Planers and shapers	10,037	22,532
Surface grinding machines	1,515	19,689
External cylindrical grinding machines	74,874	156,258
Tool grinding cutter grinding and universal grinding machines	29,829	23,791
Other metal grinding machines	70,718	75,046
Sheet and plate metal working machines	319,482	531,747
Forging machinery	57,965	106,981
Rolling mill machinery	85,329	30,972
Foundry and molding equipment	238,680	49,435
Other power-driven metal-working machinery and parts	304,576	248,684

BUSINESS ITEMS

The Lincoln Electric Co., Cleveland, Ohio, manufacturer of "Linc-weld" motors and "Stable Arc" welders, has changed its New York office from 136 Liberty St. to the new McGraw-Hill Bldg. at 330 West 42d St. The new offices will include a showroom of equipment and facilities for the demonstration of motors, welders, new electrodes and innovations in welding technique. G. N. BULL continues as district manager in New York. Branch offices have also been established in Scranton and Allentown, Pa., D. LEVENSON being in charge of the first and F. SHACKLETON covering the latter territory. Both were formerly welding technicians with the Lincoln Philadelphia office.

The Ajax Flexible Coupling Co., Westfield, N. Y., has received an order for more than 800 flexible couplings, to be used on conveyor drives to be installed in the new Chicago Post Office. This is probably the largest order ever placed for flexible couplings for a single conveyor system. They will have interchangeable flanges, use rubber bushings, graphited bronze bearings, alloy steel drive studs and will require no lubrication.

Because of the tariff placed by Britain against foreign goods, the United Typewriter Co., Ltd., has announced the erection of a plant in Toronto, Ont., for the manufacture, sale and export of Underwood typewriters. Heretofore the Canadian representative (the United) of the Underwood Typewriter Co. of the United States has assembled machines in Canada.

Sale of the Kari-Keen Mfg. Co., and the Irving Engineering Co., an associated concern which manufactured auto specialties, has been ordered for Dec. 11 by Judge Miles W. Neby in district court, Sioux City, Iowa, where the two concerns are located.

The A. Johnson Forge & Machine Co., South Bend, Ind., has broken ground for a new factory building of steel, glass and concrete construction, 60 x 100 ft.

The manufacture in Toronto for the Canadian market of steam traps, a product of the Armstrong Machine Works, Three Rivers, Mich., already in use extensively throughout Canada but until now imported into the Dominion, is announced by the Toronto Industrial Commission. Manufacturing will be undertaken by the Arthur S. Leitch Co., previously agent for the United States company.

Sheldon, Morse, Hutchins & Easton has been formed with offices at 191 West 10th St., New York City, by DR. H. H. SHELDON, H. A. MORSE, L. W. HUTCHINS, and DR. W. H. EASTON. The group plans to furnish manufacturers with a complete sales research, advertising, and publicity service.

The Rockne Motors Corp. has been organized under the laws of Delaware as a wholly-owned subsidiary of the Studebaker Co., South Bend, Ind., and will manufacture a new six-cylinder car named the "Rockne" in two series, comprising several body types on wheelbases of 110 and 114 in. The new cars will be manufactured at plants in South Bend and Detroit. A. R. ERSKINE, president of Studebaker, is chairman of the Rockne company, of which H. S. VANCE is president and R. A. VAIL and GEORGE M. GRAHAM are vice-presidents in charge of manufacturing and sales respectively.

The Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich., has appointed FRED D. HASSLER, 2905 Sterick Bldg., Memphis, Tenn., as a manufacturer's representative to handle a complete line of Ex-Cell-O products. Mr. Hassler has the exclusive territory of Tennessee, Arkansas, Mississippi and Louisiana.

Remington Typewriters, Ltd., will have to enlarge the factory space of the Toronto, Ont., plant to provide for increased production as a result of the British tariff announcement. The company expects to double its full-time staff and also the quantity of Canadian materials used.

The Perin-Walsh Co., 1540 Columbus Ave., Boston, Mass., has moved to its new Cambridge plant, factory and salesroom at Fifth & Brent Sts., East Cambridge, Mass.

PERSONALS

GUY A. BAKER has been placed in charge of the direct sales office opened in Buffalo by the Duriron Co., Inc., Dayton, Ohio.

KENNETH H. CONDIT, publishing director and editor, *American Machinist* and *Product Engineering*, has been appointed to represent the American Society of Mechanical Engineers on the American Standards Association Sectional Committee on Preferred Numbers.

R. Y. COPLAND, formerly director of the planning and engineering department of the Dominion Rubber Co., Ltd., Kitchener, Ont., Canada, has become factory manager.

W. T. DONKIN, formerly chief engineer of the Cleveland Wire Spring Co., has become assistant general manager of the coil-spring division of the Eaton Spring Co., Detroit. H. H. CLARK, formerly a member of the sales and engineering staff of the Cleveland Wire Spring Co., stationed in Detroit, has become chief engineer of the coil-spring division of the Eaton Spring Co.

DON M. DUNCAN, formerly assistant chief engineer of the Duplex Printing Press Co., Battle Creek, Mich., has been appointed assistant mechanical superintendent for the *Cleveland Shopping News*, Cleveland, Ohio.

FREDERICK J. FAY, formerly foundry superintendent of the Gifford-Wood Co., Hudson, N. Y., has been made foundry superintendent of the Finch Mfg. Co., Scranton, Pa.

SAMUEL FRANKEL, formerly chief metallurgist and director of sales of the Niagara Falls Smelting & Refining Corp., Buffalo, has been appointed director of sales of the special alloys department, Federated Metals Corp.

CHARLES O. GUERNSEY, formerly chief engineer of the automotive car division of the J. G. Brill Co., Philadelphia, Pa., has been made chief engineer. He held the former position since 1923, before which he had been connected for eight or more years with the Service Motor Truck Co., of Wabash, Ind.

SAMUEL M. HASTINGS, chairman of the finance committee of the Dayton Scale Co., Chicago, has been nominated for president of the Illinois Manufacturers' association for 1932. THOMAS S. HAMMOND, chairman of the Whiting Corp., Harvey, Ill., has been nominated for first vice-president, and HARVEY A. J. MCKAY, Mathiessen & Hegeler Zinc Co., LaSalle, Ill., has been nominated second vice-president.

W. S. HOVEY resigned as president and general manager of the Fairbanks, Morse & Co., Chicago, Ill., at the annual meeting of the board, and COL. ROBERT H. MORSE, former vice-chairman, was elected to succeed him.

ROBERT N. JANEWAY, formerly connected with the Chrysler Corp., Detroit, in a consulting capacity has now become permanently connected as consulting engineer in the research division in association with R. K. LEE, director of research.

L. J. JURSEK, superintendent of tools and factory equipment for the Bundy Tubing Co., Detroit, has resigned.

O. T. KREUSSER, for a time director of the General Motors Proving Ground at Milford, Mich., and during the past year in charge of engineering tests for the Fisher Body Corp., division of General Motors, has become director of the Museum of Science and Industry, Chicago.

HARRY G. LAMKER, formerly secretary-treasurer of the Alloys Foundry Corp., West Paterson, N. J., has become foundry superintendent for the Wright Aeronautical Corp., Paterson, N. J.

FRIEDRICH WILHELM LAMPE, formerly experimental and mechanical engineer for the Precision Balancing Machine Co., Minneapolis, Minn., has become an experimental engineer in the Chevrolet experimental engineering laboratory of the General Motors Corp., Detroit, Mich.

CARLETON JOHN LAUER, formerly chief engineer and manager of the refrigeration division of Brooks Steam Motors, Inc., Buffalo, N. Y., has become an experimental engineer with the A. C. Spark Plug Co., Flint, Mich.

ROBERT P. LAY, formerly assistant chief engineer with the H. H. Franklin Mfg. Co., Syracuse, N. Y., has joined the National Transit Pump & Machine Co., Oil City, Pa.

GEORGE E. MADDEN, formerly with the Industrial Silica Corp., Pittsburgh, has joined the sales department of the Duquesne Steel Foundry Co., and the Wheeling Mould & Foundry Co., with offices in the Grant Bldg., Pittsburgh.

WILLIAM J. MAYER, formerly sales engineer for the Brockway Motor Truck Corp., New York City, has become assistant to the chief engineer of the Edward G. Budd Mfg. Co., Philadelphia, Pa.

J. L. MCCLOUD, metallurgical engineer, Ford Motor Co., Detroit, spoke at the twenty-seventh meeting of the New Jersey chapter, A.S.S.T., Dec. 1. His subject was "Automotive Steels."

W. J. MCVICKER is now general manager of W. J. McVicker & Son, consulting engineers, of Minneapolis, engaged in designing agricultural, industrial and automotive machinery. He was formerly chief engineer of the threshers division of the Moline Power Implement Co., also of Minneapolis.

YOSHIO OGAWA, formerly owner of the Ogawa Co., Daytona Beach, Fla., has become assistant general manager, in charge of service, for the Palama Auto Co., Honolulu, T. H.

GEORGE C. PASCALL has been made president and treasurer of the Pickering Governor Co., Portland, Conn. HEMAN ELY has been elected chairman of the board to succeed the late STEPHEN S. HALL.

A. B. PURVIS, president and general manager of Canadian Industries, Ltd., Montreal, has been elected president of Dunlop Tire & Rubber Goods, Ltd., Toronto, in succession to E. B. Ryckman, who has retired from that office.

FRED RATH, formerly tool designer for the Continental Motors Corp., Muskegon, Mich., has become a die designer with the Briggs Mfg. Co., Detroit.

DANIEL FELIX RITCHIE, formerly equipment sales engineer for the Allis-Chalmers Mfg. Co., at Springfield, Ill., has become a designing engineer with the LaPlante Choate Mfg. Co., Cedar Rapids, Iowa.

W. E. Ross, industrial control engineer of the Peterborough, Ont., plant of the Canadian General Electric Co., Ltd., has been promoted to the position of manager of the contract service department of the head office in Toronto.

DANIEL SHARPE, for the past 10 years manager of Foundry Plant & Machinery Ltd., Glasgow, Scotland, has received an appointment with Walter Macfarlane & Co., Glasgow, necessitating his resignation as manager, although he has retained his connection with Foundry Plant & Machinery Ltd. as a member of the board of directors. JAMES AFFLECK, formerly foundry manager of G. & J. Weir Ltd., Cathcart, Glasgow, has been made manager to succeed Mr. Sharpe.

WILLIAM VAUGHAN, formerly general purchasing agent of the Heintz Mfg. Co., Philadelphia, has joined the sheet sales department of Mill-Chase & Co., Philadelphia.

E. W. TEMPLIN has been appointed chief engineer of the Curtis Mfg. Co., Los Angeles.

ANDREW M. WHITE, formerly engineer in the Brooklyn, N. Y., office of the New York Telephone Co., has become a sales representative.

HAROLD F. WOOD, who has been chief metallurgist of the Ingalls-Sheppard division of the Wyman-Gordon Co., in Harvey, Ill., since 1920, has been advanced to the post of works manager of that division.

CARY WRIGHT has been appointed manager of the Ideal Furnace Co., Milan, Mich., to succeed EVERETT BETTS, resigned.

OBITUARIES

THOMAS H. APPLEBY, proprietor of the T. H. Appleby Co., manufacturer of automobile parts and accessories, in Syracuse, N. Y., died Nov. 23 there.

RICHARD BILLINGS, 56, president of the Woodstock Railway Co., and former president of the Connecticut River Railroad Co., died at his home in New York City Dec. 3 of heart disease after a long illness.

GEORGE S. CROSBY, 84, retired manufacturer of iron articles, who has been called "the father of the malleable iron toy," died Dec. 6 at his home in Simonsville, Vt. He had been in failing health for some time. A skillful foundryman, he started the malleable iron toy industry in Bridgeport, Conn., and later established a factory in Brooklyn, N. Y. This was moved in 1889 to Buffalo, where the business was extended to include general stamping of sheet metals. In Buffalo Mr. Crosby improved the process used in the manufacture of hacksaws. For some time before his retirement in 1918 he was associated with the late EDWARD G. HEWITT in experimental work in Brooklyn.

HUGH G. CURRAN, JR., 34, vice-president of the Commonwealth Steel Co., trial engineers of 60 Broad St., New York, N. Y. died there Dec. 6.

ALPHA G. GENTRY, 58 years old, treasurer of the Home Elevator Co., Indianapolis, Ind., died recently. Mr. Gentry had been engaged in the manufacture of elevators for 33 years.

CLARENCE H. HOWARD, former president of the Commenwealth Steel Co., Granite City, Ill., died Dec. 6 at Boston, Mass., after a long illness from heart disease. He had risen from machinist's helper to prominence in the steel industry. For more than 23 years he headed Commonwealth, retiring last April, two years after it had been merged with the General Steel Castings Corp., Philadelphia, Pa., under the name of the latter. Under his management Commonwealth was perhaps the leading manufacturer of cast-steel locomotive beds.

J. G. LIDGERWOOD, 52, owner with his brother, JOHN H. LIDGERWOOD, of the Lidgerwood Mfg. Co., manufacturer of hoisting machines, 326 Frelinghuysen Ave., Newark, N. J., died suddenly Nov. 30 there. He had been in ill health for some time.

LOUIS H. MARTENS, 73, president of the Humboldt Mfg. Co., Chicago, died Nov. 29 there of injuries suffered on Nov. 18 when a bicyclist struck him. Born in Germany, he came to Chicago fifty years ago.

WILLIAM C. PRENDERGAST, 50, a former executive of the Republic Steel Corp., who retired last year, died suddenly Nov. 30, in New York City.

GEORGE H. RAYMOND, 76, president of the Federal Telephone & Telegraph Co., Buffalo, N. Y., died suddenly Nov. 30.

HENRY WALTERS, 83, financier and chairman of the board of the Atlantic Coast Line Railroad, died Nov. 30 after a short illness.

WILLIAM A. WILSON, 63, of the firm of Williams & Wilson, machinery brokers, Montreal, died suddenly at his home in Montreal on Nov. 23. Mr. Wilson lived for some years in London, Ont., but moved to Montreal in 1895 when he joined his brother, F. C. WILSON, in the firm of Williams & Wilson.

MEETINGS

SEVENTH ANNUAL CONFERENCE ON WELDING
to be held by the Engineering Extension Department of Purdue University at Lafayette, Ind., Dec. 10-11.

STEEL FOUNDERS SOCIETY OF AMERICA
December meeting, William Penn Hotel, Pittsburgh, Pa., Dec. 10. G. P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

NATIONAL AUTOMOBILE SHOW
New York, Grand Central Palace, Jan. 9-16; Chicago, Coliseum, Jan. 30-Feb. 6.

STEEL FOUNDER'S SOCIETY OF AMERICA, INC.
Annual meeting, Chicago, Ill., Jan. 21, 1932. G. P. Rogers, managing director, 932 Graybar Bldg., New York City.

NATIONAL ASSOCIATION OF ENGINE & BOAT MANUFACTURERS
Motorboat and marine engine show, Grand Central Palace, New York City, Jan. 22-30, 1932. Henry R. Sutphen, president.

SOCIETY OF AUTOMOTIVE ENGINEERS
Annual meeting, Book-Cadillac Hotel, Detroit, Mich., Jan. 25-29. John A. C. Warner, secretary, 29 West 39th St., New York, N. Y.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Annual Winter meeting, Engineering Societies Bldg., New York, N. Y., Jan. 25-29. F. L. Hutchinson, secretary, 33 West 39th St., New York City.

SECOND INTERNATIONAL HEATING & VENTILATING EXPOSITION
Sponsored by American Society of Heating & Ventilating Engineers, in Grand Central Palace, New York City, Jan. 25-29. Charles F. Roth, manager, Grand Central Palace, New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION
Packaging, packing and shipping exposition Palmer House, Chicago, Ill., Mar. 7-12, 1932. W. J. Donald, managing director, Room 602, 225 West 64th St., New York, N. Y.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Calif., Conford—Pacific Gas & Electric Co., 245 Market St., San Francisco, will receive bids in near future for construction of distribution plant including repair shop, etc. here. Estimated cost $50,000.

Calif., Los Angeles—Karl Stobel Corp., plans construction of a 1 story, 80 x 80 ft. plant for the manufacture of welding equipment. Estimated cost $21,000. B. H. Eaton, Los Angeles Railway Bldg., Archt.

Colo., Pueblo—Rocky Mountain Plating Works, c/o William H. Raschke, will start work in January on remodeling of electroplating plant including rust proofing equipment and department. Noted October 8.

Conn., New Haven—Auto Electric Sales & Service Co. Inc., 267 Park St., will soon award contract for construction of a 1 story service station at Cofe and Sperry Sts. Estimated cost $40,000. Brown & Van Buren, Temple St., Archts.

Fla., Tallahassee—Tallahassee Motor Co., will soon award contract for construction of a 1 story, 83 x 190 ft. garage building. Estimated cost $30,000. Alvin R. Moore, Tallahassee, Archt.

Ind., Elkhart—Illinois Carton & Label Co., awarded contract for construction of a 1 story, 130 x 200 ft. factory at Clark and Elkhart Sts. Estimated cost $40,000. Noted November 26.

Ind., Evansville—Servel Sales Inc., 231 South La Salle St., Chicago, Ill., manufacturers of electric refrigerators, awarded contract for addition to factory at 19 Morton Ave. here. Estimated cost $40,000.

Ind., Muncie—Indiana Steel Wire Co., awarded contract for construction of a 1 story, 60 x 280 ft. factory on Jackson St. Estimated cost $40,000.

Ia., Cedar Rapids—Cedar Rapids Paper Box Co., R. L. Savage, Secy., plans construction of a 1 story addition to factory at 1113 Sixth St. S. E. Private plans.

Ia., Spencer—F. X. Maurer, has been granted permit to construct hay baling press manufacturing plant and machine shop on East Second St.

Mass., Chicopee—Palmer Steel Co. Inc., 1694 Main St., Springfield, will build a 1 story, 60 x 360 and 80 x 160 ft. factory on Meadow St. here. Estimated cost $40,000. Private plans. Work will be done by owners forces.

Mich., Detroit—F. L. Jacobs Co., 6901 East Lafayette St., will soon award contract for a 1 story addition to plant for the manufacture of metal tubing. Estimated cost $30,000. Austin Co., 16112 Euclid Ave., Cleveland, O., Engr.

Mich., Muskegon—Alaska Refrigerator Co., Muskegon, subsidiary of Norge Corp., 7601 Central St., Detroit, will build an electric refrigerating manufacturing plant here. Estimated cost to exceed $100,000. Work will be done by day labor and separate contracts.

Minn., Minneapolis—E. H. Conary, 2416 Humboldt Ave. S., plans construction of a 1 story, 24 x 60 ft. repair and service garage at 19th Ave. E. and Lake St. Private plans.

N. J., Jersey City—J. Goldenberg, 80 Woodland Ave., Englewood, having revised preliminary plans prepared for construction of a 15 story garage building. Estimated cost $600,000. Charles Shilowitz, 26 Journal Sq., Archt. Noted June 18.

N. J., Jersey City—Gibralter Electric Clock Co., Inc., Joseph Gottlieb, Pres., 66 Nassau St., New York, N. Y., plans alterations to and re-equipment of manufacturing plant at Bramball, Woodward and Van Horne Sts. here. Estimated cost to exceed $40,000, including equipment. Architect not selected.

N. J., Little Falls—F. W. Wentworth, 140 Market St., Paterson, Archt., is receiving bids for a 2 story, 140 x 280 ft. garage and 65 x 85 ft. laundry building, for Little Falls Laundry Co., Main St., Little Falls. Estimated cost $150,000. Otto E. Goldschmidt, 110 West 40th St., New York, N. Y., Engr. Noted November 19.

N. J., Somerville—P. C. Van Nuys, 1 West Main St., Archt., will receive bids about February 1 for a 2 story, 100 x 200 ft. garage and stores building for Owner, c/o architect. Estimated cost $150,000. Noted November 19.

N. Mex., Albuquerque—U. S. Indian Bureau, Washington, D. C., plans construction of a 3 story hospital building including nurses home, garage, etc. here. Estimated cost $375,000. Work will be done under the supervision of L. A. Lowers, Supt. of Southern Pueblo Agency.

N. Y., Elmira—Dept. of Correction, State Office Bldg., Albany, plans construction of a new shop at State Reformatory here. Cost $75,000 including equipment.

N. Y., Glendale—Asco Supply Co., 88th St. and Cooper Ave., will build a 1 story, 100 x 166 ft. metal pipe shop and storage building. Work may be done by day labor and separate contracts.

N. Y., Long Island City—Queens Borough Gas & Electric Co., 160 Central Ave., plans construction of a 3 story work shop and service building at Beach Channel and West 108th St. Dr. Estimated cost $60,000. Work will be done by day labor under the supervision of E. L. Phillips & Co., 50 Church St., Engrs.

N. Y., Maspeth—Realty Associates, 162 Remsen St., Brooklyn, will build a 2 story, 100 x 200 ft. service garage at Maurice and 53rd Aves. Estimated cost $100,000. Work will be done by separate contracts.

N. Y., New York—Domenico Sabbatino, 1839 Sedgwick Ave., will receive bids about April 1, 1932, for construction of a 2 story, 100 x 164 ft. garage and gas station at Sedgwick Ave. and 169th St. Estimated cost $45,000. DeRose & Cavalieri, 370 East 149th St., Archts. Project held pending grant of permit. Noted November 19.

N. Y., New York—Five Hundred Fourteen West 23rd St. Corp., 100 Southern Blvd., will award general contract late in December for a 4 story, 98 x 122 ft. garage and storage building. Estimated cost $130,000. R. G. Cory, 30 Church St., Archt. Noted October 22.

N. Y., Woodside—R. Stonel, 39-33 Queens Blvd., Long Island City, having sketches made for construction of a 111 x 222 ft. service garage, etc., at Queens Blvd. and 51st St. Estimated cost $40,000. C. Ungarleider, c/o owner, Archt.

Pa., Beaver Falls—Mayor China Co., completed plans for rebuilding mould factory, power plant, etc. at Second Ave. and Fourth St. destroyed by fire. $200,000. Private plans. Noted October 15.

Pa., Neville Island—Frick Reid Supply Corp., Sandusky and Robinson Sts., Pittsburgh, will build a pipe fabricating plant and warehouse here. Estimated cost $50,000. Private plans.

Pa., Philadelphia—National Casket Co., 2043 Arch St., completed plans for 4 story, 45 x 157 ft. manufacturing plant at 1519-21 Fairmount Ave. Private plans.

S. D., Watertown—Cave Motor Co., E. A. Cave, Prop., 513 Second St., N. W., awarded contract for a 1 story, 46 x 140 ft. service garage on West Kamp Ave. Estimated cost $25,000.

Tex., Jasper—Evans Products Co. Inc., Union Trust Bldg., Detroit, Mich., plans construction of unit 1 and 2 of crate and wood products plant here, ultimate 12 units. Private plans. Machinery and equipment will be required.

Tex., Tahoka—Continental Chemical Co., Burt Bldg., Dallas, will soon receive bids for construction of a group of buildings for chemical plant including evaporating building, pumping equipment, etc. here. Estimated cost $1,000,000.

Wis., Alma—Buffalo County, S. Meyer, Clk., plans construction of a 1 story maintenance and machine shop. Estimated cost $20,000.

Wyoming—State Highway Commission, Cheyenne, awarded contracts for construction of 30 x 80 ft. shop at Laramie and 42 x 124 ft. shop at Kemmerer. Noted October 22.

B. C., New Westminster—S. & M. Hardwood Co., completed plans for construction of a 2 story mill.

Ont., Toronto—United Typewriter Co., Ltd., 354 Victoria St., subsidiary of Underwood-Elliott-Fisher Co., 342 Madison Ave., New York, N. Y., plans addition to plant for the manufacture of parts at Toronto.

England—Remington Typewriters Ltd., subsidiary of Remington Rand Inc., Tonawanda, N. Y., plans construction of a branch manufacturing plant here. Location not disclosed.

Equipment Wanted

Calif., San Diego—Bureau of Supplies & Accounts, Navy Dept., Washington, D. C.—will receive bids until December 15 for two motor driven engine lathes for Navy Yard here.

D. C., Washington—Bureau of Supplies & Accounts, Navy Dept.—will receive bids until December 15 for four motor driven engine lathes at Navy Yard, New York or San Francisco, Calif. Sched. 7027.

Mich., Detroit—Detroit Tool & Forge Co., 656 Smith St., Kerr Vollis, Purch. Agt.—machine shop equipment.

N. Y., Brooklyn—Bureau of Supplies & Accounts, Navy Department, Washington, D. C.—will receive bids until December 15 for machine tools, tap wrenches, electric drills and grinders, motor driven radial drills, arc welding sets, etc., for Naval Supply Depot here.

Tex., Bastrop—Edward Bros. Lumber Co.—complete new machinery and equipment for proposed sawmill.